



SOCIETY FOR PEDIATRIC AND PERINATAL EPIDEMIOLOGIC RESEARCH  
reproduction | pregnancy | fetal development | child | adolescent health



Artist: Danya B

**26<sup>th</sup> Annual Meeting**  
**Boston, Massachusetts**

**June 17 - 18, 2013**

**SOCIETY FOR PEDIATRIC AND PERINATAL  
EPIDEMIOLOGIC RESEARCH  
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**2012-2013**

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**SOCIETY FOR PEDIATRIC EPIDEMIOLOGIC RESEARCH  
(1988-1997)**

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## 2013 AWARD WINNERS

The Society wishes to extend our congratulations and best wishes to this year's award winners!

### **Student Prize Paper: Winner**

“Sugar-sweetened beverage consumption and age at menarche”

Jenny L Carwile, MPH, ScD  
Harvard School of Public Health

### **Heinz Berendes International Travel Award**

“Unexplained variation in hospital cesarean delivery rates”

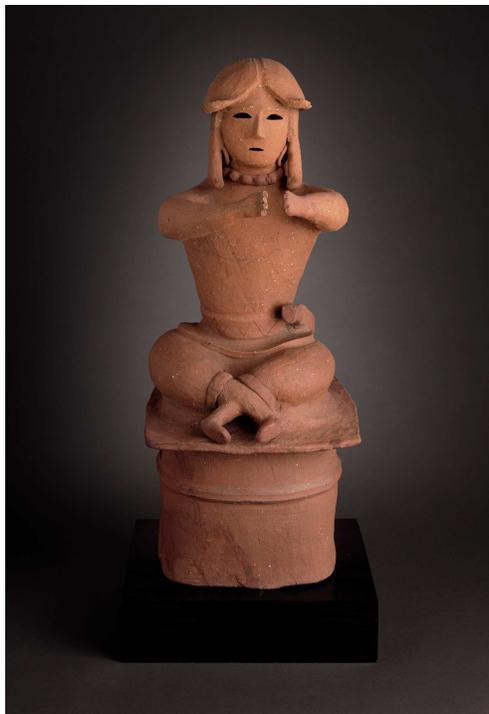
Yuen Ye (Cathy) Lee, MBIostat  
University of Sydney

### **Mentoring Award**

Sven Cnattingius, MD, PhD  
Karolinska Institutet

### **Rising Star Award**

Jennifer Hutcheon, PhD  
University of British Columbia

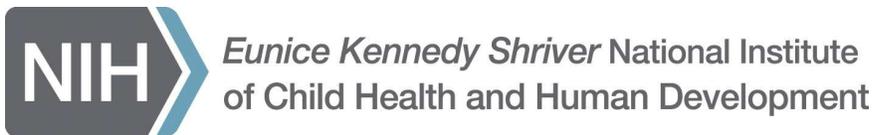


Haniwa: Seated Warrior; Japan

<http://www.lacma.org>

## ACKNOWLEDGEMENT OF FINANCIAL SUPPORT

The Society wishes to acknowledge the generous financial support for this annual meeting provided by The Eunice Kennedy Shriver National Institute of Child Health and Human Development and the National Institute of Health Office of Disease Prevention.



## Advertisements



# APPLY FOR A TIGRE GRANT



The Training in Global Reproductive Epidemiology (TIGRE) grant prepares a new generation of scientists in the most advanced research methods to address women's and children's health issues, both domestically and internationally.

**T**IGRE is a predoctoral training program in reproductive, perinatal, and pediatric epidemiology funded by the NIH T32 grant mechanism.

Trainees work closely with a mentor from the epidemiology department, as well as faculty from maternal and child health, global health systems and development, and tropical medicine, when appropriate. Trainees complete coursework in epidemiologic and statistical methods, reproductive epidemiology, and maternal and child health. Each trainee will complete a dissertation on some aspect of reproductive, perinatal, or reproductive epidemiology.

### THE GRANT PROVIDES:

- › tuition for up to three years of study
- › a stipend to cover living expenses
- › health insurance and fees
- › travel and conference expenses

### WHO SHOULD APPLY:

- › Highly qualified students who meet the epidemiology department's admission requirements for doctoral students (see <http://www.sph.tulane.edu/epidemiology/admission.html> for more details)
- › Current doctoral students planning to conduct research in pediatric, perinatal, or reproductive epidemiology
- › Students who are U.S. citizens or who have permanent residence status

### CONTACT:

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## Perinatal Epidemiology Fellowship

### NICHD SUPPORTED T-32 TRAINING PROGRAM

#### Program Director:

#### Nigel Paneth, MD, MPH

University Distinguished Professor  
Epidemiology & Biostatistics  
Pediatrics & Human Development  
218 West Fee Hall  
East Lansing, MI 48824  
paneth@msu.edu

#### Associate Director:

#### James Pivarnik, PhD

Professor  
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#### ACTIVE RECRUITMENT FOR 2014-2015

Join our two- to three-year training program in epidemiological approaches to conducting and leading research in human health phenomena occurring in the perinatal period— from mid-pregnancy until infancy. Build your research career with the expert guidance of our training faculty who have a history of NIH-funded research in obstetric, perinatal and child health.

**Post-doc & Pre-doc Funding:** Support includes health, tuition, supplies, travel and annual stipend depending on status. (Pre-doc: \$22,032; Post-doc: \$39,264 - \$54,180 depending on years post terminal degree.)

**Application:** Open to U.S. citizens / permanent residents. Applications from clinicians in obstetrics and pediatrics are encouraged. Send letter of interest and CV to Dr. Paneth (paneth@msu.edu) before September 1, 2013.

Pre-doctoral students must be enrolled in the doctoral program in the Department of Epidemiology & Biostatistics at MSU.

<http://www.epi.msu.edu/perinatal/>

# MICHIGAN STATE UNIVERSITY



# Society for Pediatric and Perinatal Epidemiologic Research

## 26<sup>th</sup> Annual Meeting

June 17-18<sup>th</sup>, 2013 - Boston, Massachusetts

### Program

Monday, June 17<sup>th</sup>, 2013

**1:00 – 3:00 pm**      **Executive Committee Meeting**  
*Hancock*

**2:30 – 5:30 pm**      **Advanced Methods Workshop**  
*Plaza Ballroom*

Biomarkers and measurement error beyond conventional methods -  
Enrique Schisterman and Neil Perkins

Propensity-score analysis: matching, weighting, and stratification in Stata  
and R - Whitney Robinson and Bryan Lee

**4:30 – 7:30 pm**      **Registration**  
*Mezzanine Level*

**6:00 – 7:00 pm**      **Panel Discussion: Advocacy in Reproductive, Perinatal, and Pediatric  
Epidemiology**  
*Plaza Ballroom*

**7:00 – 8:30 pm**      **Welcome Reception and Poster Session A with Poster Tours**  
*Georgian*

Poster tours will be available.

<b>Birth Defects</b>	<b>A1-A9</b>
<b>Child Development</b>	<b>A10-A27</b>
<b>Fertility</b>	<b>A28-A38</b>
<b>Pregnancy Complications/Outcomes</b>	<b>A39-A109</b>
<b>Methods</b>	<b>A110-A119</b>
<b>Gynecologic</b>	<b>A120-A124</b>

**Tuesday, June 18<sup>th</sup>, 2013**

**6:30 – 8:00 am**      **Continental Breakfast**

**7:00 – 10:00 am**      **Registration**  
*Mezzanine Level*

**7:00 – 8:00 am**      **Roundtable Discussions: by ticket only (sign up at registration)**

- 1) Assessing duration of attempts to conceive and subfertility  
Joe Stanford- *Hancock*
- 2) Data sharing in a big data world  
Gwen Coleman- *Fairfield*
- 3) Dealing with cranky editors, obtuse reviewers, and other authors  
ordeals  
Allen Wilcox- *Back Bay*
- 4) Meet the Editors: Paediatric and Perinatal Epidemiology  
Cande Ananth- *Whittier*

**8:00 – 8:15 am**      **Welcome Remarks:** Robert Platt, President  
*Imperial Ballroom*

**8:15 – 9:30 am**      **Plenary I: *Pre-eclampsia and Hypertensive Disorders***  
**Moderator: Sunni Mumford**  
*Imperial Ballroom*

*Recurrence of gestational hypertensive disorders and impact on newborn  
outcomes - Nansi Boghossian*

*Pre-eclampsia and development of breast cancer - Mads Kamper-  
Jorgensen*

*Validity of preeclampsia registration in the Medical Birth Registry of  
Norway for women participating in the Norwegian Mother and Child  
Cohort Study, 1999-2010 - Kari Klungsoyr*

*Elevated maternal mid-trimester serum inflammatory cytokines among  
women with preeclampsia - Brandie Taylor*

*Preterm preeclampsia, fetal growth and long-term maternal mortality -  
Rolv Skjaerven*

**9:30 – 10:00 am**      **Morning Break**

- 10:00 – 11:15 am**     **Plenary II: *Reproduction and Pregnancy Outcomes***  
**Moderator: Nel Roeleveld**  
*Imperial Ballroom*
- Randomized clinical trial of preconception low dose aspirin use to improve pregnancy outcomes: EAGeR (Effects of Aspirin in Gestation and Reproduction) Trial - Enrique Schisterman*
- Low technology assisted reproduction and preterm birth - Carmen Messerlian*
- The effect of perceived stress on reproductive function - Karen Schliep*
- Large-for-gestational-age birthweight: does customization improve detection of adverse perinatal outcomes? - Lindsey Sjaarda*
- The NICHD Consecutive Pregnancy Study: Risk factors for recurrent preterm birth - S. Katherine Laughon*
- 11:15 – 11:30 am**     **Student Prize Paper Presentation** – Martha Werler, President-Elect  
 Jenny Carwile  
*Sugar sweetened beverage consumption and age at menarche*
- 11:30 – 11:40 am**     **Presentation of Mentoring Award** – Martha Werler, President-Elect  
 Sven Cnattinguis
- 11:40 – 11:50 am**     **Presentation of Rising Star Award**– Martha Werler, President-Elect  
 Jennifer Hutcheon
- 11:50 am – noon**     **Presentation of Heinz Berendes Travel Award**– Enrique Schisterman,  
 Past President  
 Yuen Yi (Cathy) Lee
- Noon – 1:30 pm**     **Lunch and Poster Session B with Poster Tours**  
*Georgian*

Poster tours will be available.

<b>Birth Defects</b>	<b>B1-B6</b>
<b>Child Development</b>	<b>B7-B29</b>
<b>Fertility</b>	<b>B30-B41</b>
<b>Pregnancy Complications/Outcomes</b>	<b>B42-B113</b>
<b>Methods</b>	<b>B114-B120</b>
<b>Gynecologic</b>	<b>B121-B127</b>

- 1:30 – 2:30 pm**      **SPER Keynote Address – Doug Altman**  
**Director, Centre for Statistics in Medicine, Oxford, UK**  
*Some Statistical Challenges in Modelling Fetal Size and Growth*  
*Imperial Ballroom*
- 2:30 – 3:45 pm**      **Plenary III: *Social Epidemiology***  
**Moderator: Lynne Messer**  
*Imperial Ballroom*
- Movin' on up: The effect of social mobility on fetal growth in a cohort of Pregnant women residing in Michigan - Jaime Slaughter*
- Perceived neighborhood social and physical environment and preterm delivery in African-American women - Shawnita Sealy-Jefferson*
- Neighborhood poverty and preterm birth revisited: comparing cross-sectional measures to longitudinal poverty trajectories – Claire Margerison-Zilko*
- Preconception allostatic load and racial disparities in preterm birth, low birth weight, and small-for-gestational age: the Bogalusa Heart Study - Maeve Wallace*
- The relationship between race/ethnicity and major birth defects in the United States, 1999-2007 - Mark Canfield*
- 3:45 – 4:15 pm**      **Afternoon Break**
- 4:15 – 5:30 pm**      **Plenary IV: *Pediatric Outcomes and Child Development***  
**Moderator: Michael Kramer**  
*Imperial Ballroom*
- Gestational weight gain and early childhood growth and obesity - Jill Diesel*
- Maternal smoking during pregnancy and offspring mortality up to early adulthood: A prospective population-based Swedish cohort study - Anastasia Nyman Iliadou*
- Association of maternal prenatal trans fatty acid consumption with infant and child cognition in a U.S. cohort - Juliana Cohen*
- Caffeine intake during pregnancy and risk of cerebral palsy in offspring? A joint study in three large Nordic birth cohorts - Mette C Tollanes*
- Maternal smoking, breastfeeding, and growth and risk of overweight during infancy - Edmond Shenassa*
- 5:30 – 5:35 pm**      **Closing Remarks: Robert Platt**

**5:35 – 7:00 pm**

**Society Business Meeting (all are encouraged to attend)**

**Chair:** Martha Werler, President-Elect

*Imperial Ballroom*

**7:00 pm**

**Executive Committee Dinner**



Mother and Child  
Mexico, Southern Veracruz, Nopiloa

<http://www.lacma.org>

**Folic acid fortification of corn masa flour and neural tube defect prevention****Tinker S\*, Devine O, Mai C, Hamner H, Reefhuis J, Gilboa S, Dowling N, Honein M  
(Center for Disease Control and Prevention, Atlanta, GA)**

Hispanics in the US have a higher prevalence of neural tube defect (NTD)-affected pregnancies than non-Hispanic whites, and lower median folic acid intake. Folic acid fortification of corn masa flour (CMF) is a policy-level intervention for NTD prevention; however, the likely impact on NTD prevalence has not been estimated. We developed a model to estimate the percentage reduction in prevalence of spina bifida and anencephaly (NTDs) that could occur with folic acid fortification of CMF. Model inputs included estimates of the percentage reduction in U.S. NTD prevalence attributed to folic acid fortification of enriched cereal grain products (ECGP) (1995-1996 vs. 1998-2002), the increase in median folic acid intake after ECGP fortification, and the estimated increase in median folic acid intake that could occur with CMF fortification at the same level as ECGP (140  $\mu\text{g}/100\text{g}$ ). We used Monte Carlo simulation to quantify uncertainty. We stratified analyses by racial/ethnic group and rounded results to the nearest 10. We estimated CMF fortification could prevent 30 Hispanic infants from having spina bifida (95% uncertainty interval: 0, 80) and 10 infants from having anencephaly (95% uncertainty interval: 0, 40) annually. The estimated impact among non-Hispanic whites and blacks was smaller. CMF fortification with folic acid could prevent from 0 to 120 infants, with the most likely value of approximately 40, from having spina bifida or anencephaly among Hispanics, the population most likely to benefit from the proposed intervention. While potentially meaningful, this estimated reduction is unlikely to be discernible using current birth defect surveillance methods.

**Maternal medication and herbal use and risk for hypospadias: Data from the National Birth Defects Prevention Study, 1997-2007**

**Lind J, Tinker S\*, Broussard C, Reefhuis J, Carmichael S, Honein M, Olney R, Parker S, Werlorm M**  
(Centers for Disease Control and Prevention, Atlanta, GA)

We used data from the National Birth Defects Prevention Study, a multi-site, population-based, case-control study, to assess maternal use of common medications and herbals during early pregnancy and risk for hypospadias. We analyzed data from 1,537 infants with second-or third-degree isolated hypospadias and 4,314 liveborn male control infants without major birth defects, with estimated dates of delivery from 1997-2007. Exposure was reported use of prescription or over-the-counter medications or herbal products, from 1 month before to 4 months after conception. Adjusted odds ratios (aORs) and 95% confidence intervals (CI) were estimated using multivariable logistic regression, adjusting for maternal age, race/ethnicity, education, pre-pregnancy BMI, previous live births, maternal sub-fertility, study site, and year. We assessed 64 medication and 24 herbal components. Maternal uses of most components were not associated with an increased risk of hypospadias. Two new associations were observed for venlafaxine (aOR 2.4; 95% CI 1.0, 6.0) and progestin only oral contraceptives (aOR 1.9, 95% CI 1.1, 3.2). The previously reported association for clomiphene citrate was confirmed (aOR 1.9, 95% CI 1.2, 3.0). Numbers were relatively small for exposure to other specific patterns of fertility agents, but elevated aORs were observed for the most common of them. Overall, findings were reassuring that hypospadias is not associated with most medication components examined in this analysis. New associations will need to be confirmed in other studies. Increased risks for hypospadias associated with various fertility agents raises the possibility of confounding by underlying subfertility.

**Maternal periconceptional occupational exposure to pesticides and selected musculoskeletal birth defects**

**Kielb CL\*, Lin S, Herdt-Losavio ML, Bell EM, Chapman B, Rocheleau CM, Lawson CJ, Waters MA, Stewart P, Olney RS, Romitti PA, Cao Y, Druschel CM, and the National Birth Defects Prevention Study**  
(NYS Dept. of Health, Center for Environmental Health, Albany, NY)

Pesticides are commonly encountered chemical compounds with the potential to impact fetal development. This population-based U.S. study investigated the association between major musculoskeletal malformations and periconceptional maternal occupational pesticide exposure for a wide range of occupations. We conducted a multi-site case-control analysis using data from the National Birth Defects Prevention Study among employed women with due dates from October 1, 1997 through December 31, 2002. Cases included 871 live-born, stillborn, or electively terminated fetuses with isolated craniosynostosis, gastroschisis, diaphragmatic hernia, or transverse limb deficiencies. Controls included 2,857 live born infants without major malformations. Using self-reported maternal occupational information, an industrial hygienist used a job-exposure matrix and expert opinion to evaluate the potential for exposure to insecticides, herbicides or fungicides for each job held during one month pre-conception through three months post-conception. Exposures analyzed included any exposure (yes/no) to pesticides, to insecticides only, to both insecticides and herbicides (I+H) and to insecticides, herbicides and fungicides (I+H+F). We used logistic regression to evaluate the association between exposures and defects, controlling for infant and maternal risk factors. Occupational exposure to I+H+F was associated with gastroschisis among infants of women aged 20 years or older (adjusted odds ratio [aOR] = 1.88; 95% confidence interval [CI]: 1.16-3.05), but not for women under age 20 (aOR=0.48; 95% CI: 0.20-1.16). We found no significant associations for the other defects. Future research will assess additional measures of occupational pesticide exposure in this cohort, including cumulative dose, frequency, and intensity.

**Ambient air pollution and traffic exposures and congenital heart defects in the San Joaquin Valley of California****Padula A\*<sup>1</sup>, Tager IB<sup>2</sup>, Carmichael SL<sup>2</sup>, Hammond SK<sup>2</sup>, Yang W<sup>1</sup>, Lurmann FW<sup>3</sup>, Shaw GM<sup>1</sup>****(<sup>1</sup>Stanford University School of Medicine, Stanford, CA; <sup>2</sup> University of California, Berkeley, School of Public Health; <sup>3</sup>Sonoma Technology, Inc.)**

Congenital anomalies are a leading cause of infant mortality and morbidity. Studies indicate associations between environmental contaminants and some anomalies, although evidence is limited. We investigated associations between 7 ambient air pollutant and traffic exposures and 27 types of congenital heart defects in California, 1997-2006. We used maternal interview data from the California Center of the National Birth Defects Prevention Study and the Children's Health and Air Pollution Study to estimate the odds of heart defects with respect to quartiles of air pollutant and traffic exposures during the first two months of pregnancy. Particulate matter <10~m~m (PM10) was associated with pulmonary valve stenosis (adjusted odds ratio (aOR)=2.6; 95% confidence interval (CI): 1.2, 5.7) and perimembranous ventricular septal defects (aOR=2.1; 95% CI: 1.1, 3.9) after adjusting for maternal race-ethnicity, education and multivitamin use. Traffic density was associated with muscular ventricular septal defects (aOR=3.0, 95% CI: 1.2, 7.8). Traffic density and particulate matter <2.5 ~m~m (PM2.5) had discordant results for d-transposition of the great arteries (aOR\_Traffic=0.3; 95% CI: 0.1, 0.8; aOR\_PM2.5=2.6; 95% CI: 1.1, 6.5) and perimembranous ventricular septal defects (aOR\_Traffic=2.4; 95% CI: 1.3, 4.6; aOR\_PM2.5=0.5; 95% CI: 0.2, 0.9). Secundum atrial septal defects were inversely associated with CO (aOR=0.4; 95% CI: 0.2, 0.8) and PM2.5 (aOR=0.5; 95% CI: 0.3, 0.8). Exposure to PM10 and traffic density during early pregnancy may contribute to the occurrence of atrial and ventricular septal defects in this population. Results were mixed for other pollutants and showed little consistency with previous studies.

**Risk of spina bifida and maternal alcohol consumption during the first month of pregnancy according to folic acid intake****Benedum CM\*, Yazdy MM, Mitchell AA, and Werler MM  
(Slone Epidemiology Center at Boston University, Boston MA)**

Alcohol is a known teratogen which has been shown to induce neural tube defects (NTDs) in animal studies; however, findings in epidemiologic studies have been inconsistent. Using data from the Slone Epidemiology Center Birth Defects Study (1988-2012), we investigated the relationship between spina bifida (SB) and alcohol consumption in early pregnancy. Mothers of 776 SB cases and 8756 controls were interviewed within six months after delivery about pregnancy events and exposures, including the average number of alcoholic drinks consumed per drinking day (intensity) and the average number of drinking days per week (frequency) before and during pregnancy. Mothers were considered unexposed if they reported consuming less than one alcoholic drink per drinking day and drank less than once per week. The exposure interval of interest was the 28 days after the last menstrual period. Logistic regression models were used to calculate odds ratios (ORs) and 95% confidence intervals (CIs). No association with SB was observed across levels of either intensity or frequency of intake or for intense and frequent consumers (3 or more drinks on at least 3 days/week): adjusted OR 1.2 (95% CI: 0.6, 2.3). Of note, intake above or below the recommended amount of folic acid (400mg) did not alter risk. The results of this study suggest that maternal alcohol consumption in early pregnancy does not increase the risk for spina bifida, even among women with low folic acid intake.

**Maternal folic acid and multivitamin supplementation and risk of neural tube defects: A population-based registry study****Gildestad T\*, Nordtveit TI, Nilsen RM, Klungsøyr KM, Daltveit AK, Vollset SE  
(Institute of Public Health and Primary Health Care, University of Bergen, Norway)**

The authors investigated the association between maternal folic acid and multivitamin supplementation on the risk of neural tube defects in non-terminated pregnancies in Norway. The study was based on data from 713,502 non-terminated pregnancies recorded in the population based medical birth registry of Norway during 1999-2010. Odds ratios adjusted for maternal age, marital status, parity, pregestational diabetes and epilepsy were calculated by logistic regression analyses. Use of folic acid supplements before pregnancy was reported for 17.5% of the women, while use of multivitamin supplements before pregnancy was reported by 12.7%. During the study period, there was an increase in reported use of folic acid and multivitamin supplements both before and during pregnancy. The increase in supplement use was much higher during pregnancy than before conception. Mothers who used multivitamin supplements alone or in combination with folic acid before pregnancy, had a statistically significant risk reduction of having a child with neural tube defects compared with non users (adjusted odds ratio = 0.62, 95% confidence interval: 0.39, 0.98). Further, women who used folic acid before pregnancy had an adjusted odds ratio of 0.74, (95% confidence interval: 0.51, 1.09), relative to supplement nonusers. In conclusion, the authors found that preconceptional use of multivitamins showed a statistically significant reduction on the occurrence of neural tube defects in this population based study of non-terminated pregnancies.

## **Impact of adjusting for maternal weight on prenatal risk score for Down syndrome screening**

**Khambalia A\*, Nassar N, Morris J, Andronicos C, Tasevski V, Roberts C  
(Clinical and Population Perinatal Health Research, Kolling Institute of Medical Research, University of Sydney, Sydney, NSW, Australia)**

Background: Maternal weight, in addition to maternal age and gestational age at screening is an important component in calculating prenatal risk ratios for Down syndrome. However, the impact of missing weight information on risk ratios has not been assessed. Objective: To examine the effect of missing weight on first trimester Down syndrome risk ratios. Methods: Consecutive women attending Down syndrome screening in Northern Sydney, Australia, 2007-2009 were eligible for the study. Records were linked to a hospital obstetric database to obtain information on self-reported pre-pregnancy weight and height measurements. Where the Down syndrome data lacked maternal weight information, Down syndrome risk was re-calculated using self-reported weight. Results: Of the 2,411 screened pregnancies, 14.8% of women (n=357) were missing maternal weight. Based on self-reported pre-pregnancy data, 9.1% were underweight, 13.0% overweight, 6.9% obese and 69.7% normal weight. Of these women, 23 (6.4%) had a higher risk for a Down syndrome infant compared to their age-adjusted population risk, unadjusted for weight. Adjusting for pre-pregnancy weight, 5 women moved from being at no-risk to being at-risk, 2 women moved from being at-risk to being at no-risk, 21 women remained at-risk and 329 remained at no-risk. Conclusions: Nearly 18% of women were false negatives and would have been missed from further investigation for Down syndrome. Further efforts are needed to ensure maternal weight information is reliably collected and used for Down syndrome screening. Keywords: pregnancy, weight, body mass index, screening

**Maternal-fetal metabolic gene-gene interactions and neural tube defects in the National Birth Defects Prevention Study****Lupo PJ, Canfield MA\*, Mitchell LE, Shaw GM, Olshan AF, Finnell RH, and Zhu H (Baylor College of Medicine, Houston, TX)**

Single-gene analyses indicate that maternal genes associated with metabolic conditions (e.g., obesity) may influence the risk of neural tube defects (NTDs). However, to our knowledge, there have been no assessments of maternal-fetal metabolic gene-gene interactions and NTDs. We investigated 23 single nucleotide polymorphisms among 7 maternal metabolic genes (ADRB3, ENPP1, FTO, LEP, PPARG, PPARGC1A, and TCF7L2) and 2 fetal metabolic genes (SLC2A2 and UCP2). Samples were obtained from 737 NTD case-parent triads included in the National Birth Defects Prevention Study for birth years 1999-2007. We used a 2-step approach to evaluate maternal-fetal gene-gene interactions. First, a case-only approach was used to screen all potential interactions (n=76), as this design provides greater power in the assessment of gene-gene interactions compared to other approaches. Specifically, ordinal logistic regression was used to calculate the odds ratio (OR) and 95% confidence interval (CI) for each maternal-fetal gene-gene interaction, assuming a log-additive model of inheritance. Due to the number of comparisons, we calculated a corrected p-value (q-value) using the false discovery rate. Second, we confirmed all statistically significant interactions (q<0.05) using a log-linear approach among case-parent triads. In step 1, there were 5 maternal-fetal gene-gene interactions where q<0.05. The "top hit" was an interaction between maternal ENPP1 rs1044498 and fetal SLC2A2 rs6785233 (interaction OR=3.65, 95% CI: 2.32-5.74, p=2.09x10<sup>-8</sup>, q=0.001), which was confirmed in step 2 (p=0.00004). Our findings suggest that maternal metabolic genes associated with hyperglycemia and insulin resistance and fetal metabolic genes involved in glucose homeostasis may interact to increase the risk of NTDs.

**Risk factors for gastroschisis occurring in temporal clusters within the National Birth Defects Prevention Study sites**

**Yazdy MM\*, Anderka M, Langlois PH, Vieira VM, Reefhuis J, Shaw GM, Feldkamp M, Bell EM, Druschel CM, Mosley BS, Romitti PA, Werler MM and the National Birth Defects Prevention Study  
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Previous research has suggested that gastroschisis can occur in clusters. This study examined whether previously observed risk factors vary in their association with gastroschisis cases that do or do not occur in clusters. Using data from the National Birth Defects Prevention Study (NBDPS), a multi-site population-based case-control study, clusters were defined as >75% increase in the expected occurrence of cases in a 30-day period within any NBDPS site. Using data collected by telephone interviews, sociodemographic factors, illnesses, and behavioral factors were compared between cluster and non-cluster cases. Strength of association for each factor was assessed by estimating odds ratios (ORs) and 95% confidence intervals (CIs) using a logistic model for clustered cases overall and stratified by maternal age ('young' <25 and 'older' >25). Compared to 467 non-clustered cases, the 209 clustered cases were proportionally more likely to have less years of education, lower incomes, and lived at >1 residence during pregnancy. For illnesses and behavioral factors, site-adjusted ORs were close to 1.0. ORs were increased among older mothers but not younger mothers: alcohol use (young: 1.0 [95%CI: 0.7,1.5]; older: 1.6 [95%CI: 0.7,3.7]), illicit drug use (young: 0.75 [95%CI: 0.4,1.3]; older: 2.0 [95%CI: 0.6,6.4]), and non-steroidal anti-inflammatory drug use (young: 1.1 [95%CI: 0.7,1.7]; older: 1.9 [95%CI: 0.8,4.4]). ORs for sexually transmitted infections were increased for both age groups, but were higher in older mothers (young: 1.7 [95%CI: 0.6,4.4]; older: 3.6 [95%CI: 0.5,25.9]). However, the CIs overlap. Effect modification by maternal age of risk factors for gastroschisis clustering needs further study.

**Association between breastfeeding and infant growth: A probable reverse causality****Vyas S\*, Liu J, Karmaus W, Zhang H, Soto-Ramirez N  
(University of South Carolina, Columbia, SC)**

The association between breastfeeding and infant growth show debatable results regarding temporal sequence. This study aimed at examining the association and investigating a possible reverse causality between breastfeeding and infant growth. Infant Feeding Practices Survey II, a national longitudinal database with repeated measurements, following women prenatally and until one year postpartum (N=2914) was used. Mixed linear model assessed the impact of breastfeeding from the 2nd, 4th, 6th and 9th months on infant growth at the 3rd, 5th, 7th and 12th months, respectively. Log-linear model assessing reverse causation used infant growth data from the 3rd, 5th and 7th months and breastfeeding data from the 4th, 6th and 9th months respectively, restricting to infants' breastfed in the prior months or being exclusively breastfed in the first 5 months. Non-exclusively breastfed infants had a linear increase in mean weight-for-age z-score (WAZ) from the 3rd month (0.10) to the 7th month (0.34) while exclusively breastfed infants had a stable WAZ (0.27-0.24) (p-value for interaction=0.003). Non-breastfed infants had a higher WAZ throughout the first year (3rd month=0.20, 12th month=0.67) than infants who were ever breastfed in the first year (3rd month=0.04, 12th month=0.29) (p<.0001). Weight-for-length z-score (WLZ) showed similar results (p interaction=0.006). Log-linear model showed a 7% (95% Confidence Interval 1.00, 1.14) higher risk of continuing with exclusive breastfeeding with every unit increase in WAZ. In earlier months WAZ was better in exclusively breastfed infants. Only WAZ showed some possibility of reverse causality suggesting weight gain as a predictor of continuation of exclusive breastfeeding.

**Age at menarche and its relationship to body mass index among adolescent girls in Kuwait****Al-Taiar A\*, Al-Awadhi N, Al-Kandari N, Al-Hasan T, AlMurjan D, Salhah Ali S  
(Kuwait University, Faculty of Medicine, Kuwait)**

Background: Despite the increasing rates of childhood obesity and rapid change in socio-economic status, the mean age at menarche remains mostly unknown among contemporary girls in Kuwait and other countries in the Gulf region. This study aimed to estimate the mean age at menarche among schoolgirls in Kuwait and investigate the association between age at menarche and obesity. Methods: A cross-sectional study was conducted on 1,273 randomly selected female high school students from all governorates in Kuwait. Overweight was defined as higher than or equal to the 85th percentile and obesity as higher than or equal to the 95th percentile. Data on menarche, socio-demographic status, physical activity and diet were collected using confidential self-administered questionnaire. Results: Out of 1,273 students, 23 (1.8%) were absent or refused to participate. The mean (SD) age at menarche was 12.41 (1.24) years (95% CI: 12.35-12.48). The prevalence of early menarche, defined as less than 11 years of age, was 8.5% (95% CI: 7.0-10.2). The prevalence of obesity and overweight was 18.3% (95% CI: 16.2-20.6%) and 25.8% (95% CI: 23.42-28.30%), respectively. Early age at menarche was significantly associated with overweight and obesity before and after adjusting for potential confounders. Conclusion: Age at menarche among contemporary girls in Kuwait is similar to that in industrialized countries. There is an inverse association between age at menarche and obesity or overweight. Trends in menarcheal age should be monitored and taken into account in strategies that aim to combat obesity.

**The effects of exposure to regional anesthesia during labor and delivery on neonatal brain structure**

**Spann MN\*, Bansal R, Rosen TS, Peterson B  
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Psychiatric Institute, New York, NY)**

Recent animal and human epidemiological studies suggest that early exposure to anesthesia have adverse effects on brain development. As more than 50% of pregnant women in the United States receive regional anesthesia during labor and delivery, understanding the effects of anesthesia on brain development is of high public health relevance. We used MRI to assess the effects of anesthesia during labor and delivery. Using high-resolution MRI, we mapped morphological features of the cortical surface and brain parenchyma in 37 healthy neonates, 24 exposed and 13 unexposed to regional anesthesia. Neonates exposed to maternal anesthesia compared with unexposed neonates had enlarged frontal and occipital lobes, and right posterior portion of the cingulate gyrus, as well as reduced thalamus and basal ganglia volumes. Longer durations of exposure to anesthesia correlated positively with surface measures in the occipital lobe, and inversely with thalamus and basal ganglia volumes. The correlations of surface measures with postmenstrual age as an index of brain maturation were similar in both exposure groups and included enlargement of the frontal and occipital lobes bilaterally. This correlation was more pronounced in the infants exposed to anesthesia, and was located in the same regions where anesthesia-related enlargement was most significant. These findings are consistent with those from animal studies that demonstrate alterations in cellular and molecular processes as a consequence of anesthetic exposure during labor and delivery. Longitudinal MRI studies are needed to determine whether these morphological effects of anesthesia persist and what their consequences on cognition and behavior may be.

**Birth and postnatal anthropometric measurements and their effect on IQ and BMI at age seven years**

**Linn ML\*, Fonstad R, Spector LG, Pylipow M**  
**(University of Minnesota, Department of Pediatrics, Division of Neonatology, Saint Paul, MN)**

Objective: To determine whether birth weight, length, or body mass index (BMI), and postnatal growth rate are associated with childhood cognition and BMI in appropriate for gestational age (AGA) and large for gestational age (LGA) infants. Study Design: AGA (2495 -3997 g) and LGA infants (>3997 g at  $\geq 37$  weeks,) were identified in data from the Collaborative Perinatal Project. Infants with diagnoses affecting intelligence and growth were excluded, leaving 20,611 AGA and 1054 LGA infants. The independent variables in our models were birth weight, length, BMI, and postnatal growth at 16 weeks. Linear regression modeling was used to evaluate the relationship between these measures and Wechsler Scale of Children's Intelligence (WISC) scores and BMI at age 7 years. Results: LGA infants had higher 7-year WISC scores, with full-scale scores being 2.53 points (95%CI 1.68-3.38) above their AGA peers. While birth weight and length are positively associated with 7-year IQ and BMI in the AGA group, LGA infants exhibited positive associations for IQ and length but a negative association for IQ and birth BMI. Postnatal weight, length, and BMI gains were positively associated with 7-year IQ and BMI in the AGA group. LGA infants with increasing postnatal BMI had higher BMI at 7 with small effects on IQ. Conclusions: Prenatal and the first 4 months of postnatal growth are positive predictors of childhood cognitive function and of BMI. For LGA infants, further accelerated prenatal growth predicts lower IQ scores and accelerated postnatal growth predicts higher childhood BMI.

**Is breast best? An evaluation of maternal attitudes towards breastfeeding in Ireland****O'Sullivan AM, Lutomski JE\*****(National Perinatal Epidemiology Centre, Wilton, Ireland)**

Background: Breastfeeding has many documented benefits for both mother and infant; yet to date, less than half of Irish women report exclusively breastfeeding at hospital discharge. Aim: To better understand low breastfeeding rates in Ireland through assessing socio-demographic factors associated with attitudes and knowledge of breastfeeding in Cork, Ireland. Methods: A cross-sectional study was conducted in a prenatal clinic of a large (>8,500 deliveries per annum), tertiary maternity unit in August 2012. A detailed breastfeeding questionnaire which included the Iowa Infant Feeding Attitude Scale (IIFAS) was randomly distributed to 300 expectant mothers in August 2012. Kruskal-Wallis and  $\chi^2$  tests were conducted to explore associations between socio-demographic characteristics and breastfeeding attitudes. Results: Nearly two-thirds of mothers (63.9%) intended to breastfeed and one-quarter (24.3%) intended to formula feed their child. IIFAS scores ranged from 34 to 78, with women who originated from outside of Ireland ( $p<0.001$ ), were college educated ( $p<0.001$ ), or had previously breastfed ( $p<0.001$ ) expressing a significantly more favorable attitude towards breastfeeding. A substantial proportion of mothers did not believe that breastfeeding offers an infant protection against diarrhea (46.3%), pneumonia (44.5%), or adult obesity (61.9%). Family and the prenatal clinic were the most frequently cited sources of breastfeeding knowledge. Discussion: Despite a relatively high intent to breastfeed, recognition of associated health benefits of breastfeeding was generally low. Media and primary care settings may be underutilized forums to disseminate breastfeeding information. Mixed methods research exploring underlying reasons for unfavorable attitudes towards breastfeeding would help direct future initiatives.

**Risk factors and costs of hospital admissions in first year of life: A population based study.**

**Lain SJ\*, Bowen JR, Roberts CL, Nassar N**  
**(Kolling Institute of Medical Research, University of Sydney, Sydney, Australia)**

**Aim:** Identify the maternal and infant risk factors and associated costs of hospital readmission in the first year of life. **Methods:** Data from the Perinatal Data Collection for 599,753 liveborn infants born in New South Wales, Australia, 2001-2007 were linked to hospital admission data. Logistic regression models were used to investigate the association between maternal and infant characteristics and readmission to hospital once, and more than once in the first year; and average costs for total hospital admissions were calculated. **Results:** Almost 15% of infants were readmitted to hospital once and 4.6% had multiple readmissions. Severe neonatal morbidity was the factor most strongly associated with multiple admissions (aOR 2.60; 95% CI 2.47-2.75). Infants born less than 39 weeks gestation, to teenage mothers, mothers that smoke, are not married, or had a planned delivery also have an increased risk of multiple readmissions. Infants with severe neonatal morbidity comprised 4% of population and contributed 27% of total infant hospital costs. The mean annual cost of hospitalizations decreased on average 25% each increasing week of gestational age (GA) for infants without neonatal morbidity, and 10% each increasing week of GA for infants with neonatal morbidity. This decrease in cost continued until 39 weeks gestation. **Conclusions:** Infants born with severe neonatal morbidity have increased hospitalizations in the first year however the majority of the burden on the health system is by infants without severe neonatal morbidity. Hospitalizations, and associated costs, increased with decreasing GA, even for infants born at 37-38 weeks.

**The reliability of retrospective recall of maternal exposure to child abuse and neglect with respect to pregnancy**

**Cammack AL\*, Hogue, CJ, Knight BT, Stowe ZN, Newport DJ  
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Background: Exposures to child abuse and neglect are common and may relate to birth outcomes, psychopathology and maladaptive behaviors around the time of pregnancy. Studies pertaining to the reliability of retrospective reporting are limited with some showing suboptimal reliability, introducing the possibility of misclassification. Further, there is a lack of data collected around the time of pregnancy and little information about whether pregnancy-related factors influence reliability. Methods: Participants consisted of 244 women with history of psychiatric illness at the Emory Women's Mental Health Program. Childhood abuse (physical, emotional, and sexual) and neglect (emotional and physical) were measured with the Childhood Trauma Questionnaire Short-Form during the preconception or prenatal period (first assessment) and again during the postpartum period. The five individual trauma types were dichotomized according to recommended cutpoints as none or low versus moderate or severe. Test-retest reliability was quantified using Cohen's Kappa. Results: Women initially reported all types of abuse, with prevalence and Kappa estimates as follows: emotional abuse (19.75%, 0.62 [95% CI:0.49-0.74]), physical abuse (11.48%, 0.65 [95% CI:0.51-0.80]), sexual abuse (15.98%, 0.73 [95% CI:0.62-0.84]), physical neglect (8.68%, 0.52 [95% CI:0.34-0.70]), and emotional neglect (18.03%, 0.61 [95% CI:0.48-0.73]). Slightly higher prevalences were reported at the second assessment. Women reporting a history of unwanted pregnancy or ambivalence showed more discordant responses, namely for physical abuse and emotional neglect. Conclusion: Reliability of retrospective recall of child abuse and neglect in a psychiatric preconceptional, pregnant, and postpartum population is moderate to substantial. Factors such as pregnancy wantedness may be important determinants of reliability.

**Labor abnormalities, birth depression, and signs of brain injury in the pathway to cerebral palsy in term births: A matched case-control study**

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Ellenberg and Nelson (2012) proposed separating markers of brain injury (BI) from labor abnormalities (LA) in studying the antecedents of cerebral palsy (CP). We investigated the distinct roles of LA, birth depression (BD), and signs of BI in the pathway to CP in a case-control study of 90 children with CP born after 37 weeks gestation recruited from specialty clinics in 3 Michigan cities. Term controls were recruited in primary care and matched on year of birth and sex. Exposure information was from birth certificates, hospital discharge abstracts and maternal interviews. LA were defined as factors possibly related to interruption of oxygen supply and/or blood flow during labor. BD was defined as Apgar scores of 5 or less at 5 minutes of life. BI included recording of the terms birth injury, neonatal seizures, encephalopathy, or assisted ventilation. McNemar's Test, conditional logistic regression, and adjusted odds ratios (ORs) with 95% confidence intervals (CIs) were calculated. CP was not associated with LA (OR: 1.1; 95% CI 0.4-3.1;  $p=0.87$ ), but was associated with BD (OR: not calculable; all five discordant pairs had case exposure,  $p=0.03$ ) and with BI (OR: 4.5; 95% CI 1.6-13.3;  $p=0.005$ ). With BD in the model, the BI-CP OR was reduced to 2.7 (CI 0.8-8.6;  $p=0.10$ ). Analyses stratified by CP subtypes revealed marginally significant associations of BI with quadriplegic CP (OR: 5.7; 95% CI 0.9-35.2;  $p=0.06$ ) and hemiplegic CP (OR: 13.5; 95% CI 1.1-173.0;  $p=0.046$ ). Term births with BD and BI, but not LA, were at increased risk of CP.

**A18**

**Teen pregnancy in the United States is higher when the nativity of the mother is inside the US**

**Teji JS\*, Brar GS, Brar RK  
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Background: As the latest vital statistics have shown that teen pregnancy is dropping in the US while there are sporadic studies implicating that teen pregnancy in the US is less likely when the nativity of the mother is outside the 50 states of the US. Purpose: To test the hypothesis that teen pregnancy is lower in the mothers whose nativity is outside the 50 states of the US. Methods: VSS data from the NCHS was analyzed for the years 1995 thru 2002. Logistic regression analysis was performed with the dependent variable teen pregnancy, TP, with maternal place of birth, MPB as independent variable. The confounding variables were maternal race, gestational age, GA, birth weight, BWT, maternal conditions such as diabetes, hypertension, pregnancy induced hypertension, maternal exposure to alcohol and tobacco. Also considered variables were prenatal care, plurality, and gender. Stata 12.0 was utilized for statistical analysis. Results: Out of over 31 million records for births during the period 1995 thru 2002 over 25 million births had usable data. Over all, births to teen mothers were significantly more likely if their nativity was within the 50 states of the US, OR 2.49 cf (95%) 2.48-2.50 while controlling for other confounders. Every ethnicity and race was affected by the maternal nativity. Conclusion: 1. We accept the hypothesis that teen pregnancy is lower when the maternal nativity is outside the US. 2. Reason for higher teen pregnancy rates when mother's nativity is from the US is concerning and needs to be decreased.

**The utility of electronic medical records in evaluating neonatal feeding**

**Teji J\*, Dimitrov R**

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The importance of breast milk feeding in infancy cannot be overstated. Information on number and type of feeding for the neonate has important implications for practice as well as epidemiological research. With the goal of increasing general neonatal knowledge and tracking patient outcomes, an evaluation of neonatal feeding patterns at our hospital was conducted using a recently established Electronic Medical Records (EMR) system. Methods: EMR data for all babies for a four year period beginning Jan, 2009 and ending Dec, 2012 was used. Variables included in the data file were race, sex, date of birth year, number of feeding (1st, 2nd, 3rd) and type of feeding (breast milk, formula or both). All analyses were conducted with SPSS 21.0. Results: EMR data acquisition for analysis required programming assistance from the information systems, IS, personnel. Programming needed several revisions in order to obtain the accurate data fields that contained the documentation for the baby. Breast feeding was significantly different for each race for each year  $p=0.000$ . An independent-samples t-test comparing mean time to first feed was significantly longer for the male babies than female 35.03 hrs.  $30.3$  to  $32.30$   $20.45$ ;  $t(7.06) = 55,198$ ,  $p=0.000$  Conclusions: 1. Breast feeding pattern, type and timing for each and every feed can be an easily determined and important quality indicator. 2. Also discovered by using EMR were inaccuracies of documentation of feeding times particularly the first feed after birth. 3. EMR can be effectively utilized for the analysis of newborn feeding patterns.

**Association of individual social skills and classroom connectedness with depressive symptoms in puberty****Sato M\*, Suzuki K, Yamagata Z  
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Childhood depression, recognized as a serious disorder, has a globally increasing prevalence. An important factor related to it is social skills: the ability to communicate and interact with others. In puberty, social skills are strongly affected by social environment (especially school classroom connectedness, defined as the total of individual social skills). We examined the association of individual social skills and classroom connectedness with depressive symptoms among 1911 children from grades 4-9 in this community-based study. Depressive symptoms were assessed using the Burleson Depression Self-Rating Scale. Social skills were examined with a questionnaire generally used in Japanese schools. First, we divided 81 school classes into high-connectedness (HC) and low-connectedness (LC) groups. Second, on the basis of the mean social skills score of each class, students were divided into high-score (HS) and low-score (LS) groups. Then, groups were combined as HC-HS, HC-LS, LC-HS and LC-LS. The association between depressive symptoms and the above 4 groups was examined using multiple logistic regression analyses stratified by sex and grade. Depressive symptoms were found for 141 (7.4%) participants. Symptoms were significantly more prevalent among students categorized as LS, particularly in LC classes, compared with HC-HS students. This association was stronger in boys and 4<sup>th</sup>-6<sup>th</sup> graders. In conclusion, both individual social skills and classroom connectedness should be strengthened to prevent childhood depression. Further prospective research should be conducted to clarify the pathway and mechanisms of this association.

**Nausea and vomiting of pregnancy and neurodevelopment in offspring****Parker SE\*, Starr JR, Collett BR, Speltz, ML, Werler MM  
(Slone Epidemiology Center at Boston University, Boston, MA)**

Nausea and vomiting of pregnancy (NVP) has been linked to improved fetal outcomes, yet little is known about its association with later neurodevelopment in offspring. Eligible participants were children aged 5 to 12 years, whose mothers participated in a study of prenatal exposures and hemifacial microsomia (a birth defect). Data on demographic characteristics, reproductive history, and illnesses during pregnancy were collected through a maternal interview conducted on average 12 months after delivery. Two standardized tests, the Peabody Picture Vocabulary Test (PPVT) and Developmental Test of Visual Motor Integration (VMI), were administered to children to measure receptive vocabulary and perceptual-motor abilities. Outcomes were modeled using multiple linear regression adjusting for demographic and pregnancy characteristics and hemifacial microsomia case status. Inverse probability-weighted models were used to account for potential respondent bias. Among the 687 children that participated in the follow-up study, 62% of their mothers reported NVP. Mothers reporting NVP were more often white, non-Hispanic, college graduates, and parous. They were also more likely to be pregnant with a female than a male, (49% vs. 44%). Adjusted mean PPVT and VMI scores were lower among children exposed to NVP with differences of  $-2.21$  (95% CI:  $-4.63, 0.21$ ) and  $-2.08$  (95% CI:  $-3.93, -0.23$ ), respectively. Among female offspring, differences in both scores were more pronounced ( $-3.06$  and  $-3.47$ , respectively). Inverse probability-weighted models to account for participation strengthened associations with PPVT, but did not change results for VMI. Children exposed to NVP may have poorer neurodevelopmental outcomes. The high frequency of NVP emphasizes the importance of further study.

**Milk and meat consumption and age at menarche**

**Carwile JL\*, Willett WC, Wang M, Rich-Edwards J, Frazier AL, Michels KB (co-senior authors)  
(Harvard School of Public Health, Boston, MA)**

Background: Earlier age at menarche is a risk factor for breast and endometrial cancer. Regular consumption of milk, but not meat, increases circulating insulin-like growth factor 1 concentrations in prepubertal girls, which may impact menarcheal timing. Objective: We evaluated the associations of regular consumption of milk and meat with rate of earlier menarche. Methods: We conducted a prospective analysis with up to 5 years of follow-up in 5,584 female participants in the Growing Up Today Study cohort who were premenarcheal and ages 9-14 years in 1996. Cumulative diet was calculated using annual Youth/Adolescent Food Frequency Questionnaires from 1996-1998. Results: We observed 5,228 events of menarche over 10,556 person-years. In multivariable models, milk consumption did not predict rate of earlier menarche. However, after additional adjustment for body size, premenarcheal girls who reported consuming >3 servings of milk per day were, on average, 13% less likely to attain menarche in the next month relative to girls who reported consuming 1.1-4 servings per week (95% confidence interval: 3-23%; p-trend: 0.002) (i.e., had later menarche). Neither total meat nor red meat consumption was associated with rate of menarche (p-trend: 0.94 and 0.81, respectively). Intake of dairy protein also predicted a modestly later menarche in models adjusted for body size. Conclusions: Our findings suggest that regular milk consumption is not associated with age at menarche; however, some currently unidentified components of milk may delay menarche. We assessed diet at age 9 or older; future studies may examine associations with childhood diet at earlier ages.

**Birth-month on the risk of RSV hospitalization in the first year of life**

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**(Department of Epidemiology and Biostatistics, The George Washington University School of Public Health and Health Services, Washington, DC)**

Background: There is not yet a vaccine for Respiratory Syncytial Virus (RSV), the most common cause of severe respiratory illness in infants. To help direct existing targeted interventions and future RSV vaccine programs, we examined risk of RSV-related hospitalization by infant age and birth month. Methods: We conducted Poisson regression analyses to evaluate birth month as a risk factor for RSV-related pediatric hospitalizations (identified by any mention of ICD-9-CM diagnosis codes: 466.11, 480.1, or 079.6) from State Inpatient Data (SID) in Arizona, Iowa, New York, Oregon, and Wisconsin between July 1996 - June 2006. We used an age cohort approach to compute the total risk of RSV across the first year of life. Risk Ratios (RR) were provided with 95% Confidence Intervals [CI]. Results: We identified 82,296 RSV-related infant hospital admissions, corresponding to 13.9 per 1,000 person-years, of which 42% of the patients were female and 73% were <6 months old. One-month olds born in January were ~10 times more at risk for RSV hospitalization than 1-month olds born in October (RR: 9.8, [7.8, 12.4]). Infants born in December and January were at a 2- and 3-fold higher risk for an RSV-related hospitalization event during their entire first year of life than infants born in July. Conclusions: Birth-month and age at admission profoundly impacted the risk of RSV hospitalization within the first year of life in 5 states we investigated. Our findings may influence identification of an ideal RSV vaccine schedule, and for improved targeting of expensive prophylactic drugs.

**Parental discipline and health: A study in Generation XXI Portuguese cohort****Moreira I\*, Costa D, & Barros H  
(Institute of Public Health of University of Porto, Porto, Portugal)**

Objective: To describe parental discipline styles adopted by parents of 7 years-old children of a Portuguese birth cohort. Methods: We evaluate 3000 families of 7 years-old children as part of the follow-up of Generation XXI birth cohort (n=8647). The Parent-Child Conflict Tactics Scales were administered in private setting, by trained interviewers. Items were rated according to the original dimensions of the scale into nonviolent discipline, corporal punishment, psychological aggression and physical assault. Frequencies of these discipline styles were classified according to behaviors performed in the previous year and compared with parental education through chi-square test. Parents-child agreement was estimated through kappa coefficients. Results: Nonviolent discipline was reported by more than 99% parents and 85% children. Psychological aggression was identified in more than 90% of parents. Corporal punishment was mentioned by 88% of fathers and 95% of mothers. Physical assault was more often reported by mothers than fathers (7 vs. 4%). Severe physical assault comprised 3% of declared acts mother-son and 2% mother-daughter, while 3% father-son and 2% father-daughter. One in 5 boys and 1 in 6 girls reported severe parental physical assault. The agreement between parents-child answers was weak, with the highest kappa value observed in corporal punishment ( $k=0.293$ ). For physical assault, the lower parental education the higher the prevalence of these acts. Mothers' perpetrators of physical assault were more often victims of these acts before this child-birth (13 vs. 7%). Conclusion: We observed a high frequency of violent discipline, with differences from the perspective of parents and children.

**School-based identification of mild intellectual disability; An ecologic study****Knight JH\*, Kramer MR, Drews-Botsch C  
(Emory University, Atlanta, GA)**

Mild intellectual disability (ID) is typically diagnosed during elementary school, often as a result of teacher referral. Limited resources may reduce or delay identification of children with ID in schools in poor or rural areas but little is known about whether school characteristics influence the identification of these children. This study aimed to assess inter-school heterogeneity in identification of children with ID. These analyses use public elementary school records from all counties in Georgia (N= 1,213 schools) from 2001-2005. A Criterion Referenced Competency (CRCT) test results were used to estimate the expected, school-specific prevalence of ID. The residual count (observed-predicted) of cases was then regressed on school characteristics to identify factors affecting identification. Schools with higher proportions of children receiving free or reduced lunch and of Black children had higher proportions of children with ID and lower CRCT scores. These schools identified greater than expected numbers of children with ID (75th vs. 25th percentile of free or reduced lunch: 3rd grade RR = 1.2, 95% CI = 1.1, 1.4; 5th grade RR = 1.1, 95% CI = 1.0, 1.2). This study finds evidence for inter-school heterogeneity in mild ID prevalence, and school characteristics are associated with differences in the numbers of children identified with ID as compared to expectations based on standardized test scores. Possible explanations include school screening policies or inadequate predictive capacity of standardized tests in low income schools.

**Birth weight does not mediate the association of prenatal depressive symptoms and offspring internalizing symptoms at 22-years in a low-income cohort****Helsel AA\*, Day NL  
(University of Pittsburgh, Pittsburgh, PA)**

Depression during pregnancy is common and has independently been associated with lower birth weights and offspring mental health. Birth weight (BW) has also been associated with future psychological distress. We examined whether BW z-scores mediated the association between prenatal depressive symptoms (PDS) and offspring internalizing symptoms at 22-years within the Maternal Health Practices and Child Development prospective cohort study (n=601). Women were recruited from a low-income prenatal clinic in Pittsburgh, PA at their first antenatal visit (range: 3-5.5 prenatal months). PDS was measured at baseline with the Center for Epidemiologic Studies Depression Scale, BW was abstracted from the medical record, and gestational age was estimated by study nurses using the Dubowitz/Ballard examination method. Internalizing problem scores were computed from the Adult Self Report completed by offspring at the 22-year interview. Mediation was explored through three linear regression models in accordance with Baron and Kenny's causal steps approach and formally tested with Sobel's z-test. Controlling for prenatal maternal demographics and substance use, PDS predicted internalizing symptoms ( $\beta=1.09$ ,  $p=.019$ ), but PDS was not associated with BW z-scores ( $\beta=-.04$ ,  $p=.263$ ), resulting in a non-significant Sobel test-statistic ( $z=.95$ ,  $p=.349$ ). There was no interaction between PDS and BW z-scores ( $p=.168$ ), and results were similar when stratified by sex (47% male) and race (52% African American, 48% Caucasian). While higher PDS predicted higher internalizing symptoms, this association was not mediated by BW, suggesting that PDS has a direct effect on internalizing symptoms. Additional research is needed to understand the mechanisms underlying the association.

**Specific maternal and paternal age effects on behavior outcomes in offspring****Tearne J\*, Robinson M, McLean N, Jacoby P, Li J****(Telethon Institute for Child Health Research, Centre for Child Health Research, University of Western Australia)**

**BACKGROUND AND AIMS** This study examined the relationship between parental age and longitudinal mental health outcomes in offspring, using data from the Western Australian Pregnancy Cohort (Raine) Study. We examined what links exist between maternal and paternal age and child behaviour outcomes, and whether these relationships persist when accounting for known perinatal risk factors. **METHODS** The Raine Study provided comprehensive data from 2 900 pregnancies, resulting in 2 868 live born children. Offspring were followed up at ages two, five, eight, 10, 14, and 17 years using the Child Behaviour Checklist (CBCL). The CBCL provided clinical cut-offs for behavioural morbidity for overall, internalizing (withdrawn, anxious/depressed, somatic complaints) and externalizing (delinquent, aggressive) behaviour ( $T \geq 60$ ). We used longitudinal logistic regression models with stepwise adjustment for known prenatal risk factors (gestational age, maternal smoking in pregnancy, maternal education at pregnancy, parity, total family income and gender). **RESULTS** In the unadjusted models, as both maternal and paternal age increased, there was a significantly decreased risk for the later development of total, internalizing, and externalizing problems in children throughout childhood. In the adjusted models, maternal age remained a significant predictor of total (OR = .89, 95% CI = .81, .97), internalising (OR = .91, 95% CI = .83, .99) and externalising (OR = .89, 95% CI = .82, .97) problems, with increased age related to decreased behaviour problems in children. Paternal age was no longer significantly associated with risk for total, internalising and externalising child behaviour problems. **CONCLUSIONS** Preliminary findings indicate both advancing maternal and paternal age at conception contribute to the child's later behavioural development.

**Meat intake and semen quality among physically active young men****Afeiche M\*, Williams PL, Mendiola J, Gaskins AJ, Jorgensen N, Swan SH, Chavarro JE  
(Department of Nutrition, Harvard School of Public Health)**

**Introduction** In the United States, anabolic sex steroid hormones are administered to cattle and other animals for growth promotion. Scientific concern has been raised regarding reproductive health consequences of the hormonal residues in edible tissues. High maternal beef consumption during pregnancy has been associated with lower sperm concentration among their sons 30 years later. However, it is not known whether men's meat consumption is associated with semen quality given the paucity of literature on this topic.

**Material & methods** The Rochester Young Men's Study (n=189) was a cross-sectional study among men aged 18-22 years, conducted from 2009-2010 at the University of Rochester. Diet was assessed via food-frequency questionnaire. Linear regression was used to analyze the relation between meat intake and semen quality parameters (sperm count, concentration, progressive motility, and morphology) adjusting for age, abstinence time, race, smoking status, body mass index, recruitment period, moderate-to-intense exercise, and calorie intake.

**Results** Processed meat intake was inversely related to total sperm count (p-trend=0.06) and progressive sperm motility (p-trend=0.08). While these associations were not statistically significant, intake of unprocessed red meat was associated with significantly higher percent morphologically normal sperm. The adjusted difference in normal sperm morphology was 2.1% unit (95% CI=0.7,3.5%) higher between men in the upper vs. lower half of unprocessed red meat intake (p=0.005). Compared to non-consumers, men who consumed organ meat (median intake=0.06 servings/week) had higher total sperm count (p=0.002), concentration (p=0.03), and progressive motility (p=0.005).

**Conclusions** Our data suggest that unprocessed red meat is associated with higher percent morphological normal sperm.

**Validation of maternal self-report of assisted reproductive technology use at the Massachusetts site of the National Birth Defects Prevention Study****Liberman RF\*, Luke B, Stern JE, Reefhuis J, Gopal D, Anderka M  
(Massachusetts Center for Birth Defects Research and Prevention, Massachusetts  
Department of Public Health, Boston, MA)**

We conducted a validation study to determine the accuracy of maternal self-reported use of assisted reproductive technology (ART) from Massachusetts (MA) participants in the National Birth Defects Prevention Study (NBDPS) compared with data from ART clinics. MA NBDPS participants delivering between July 1, 2004 and January 3, 2008 (n=1,263) were matched to records in the Society for Assisted Reproductive Technology Clinic Outcome Reporting System (SART CORS) online database. Sensitivity and specificity were calculated to measure accuracy of reported ART use in NBDPS data compared with use recorded in the SART CORS data. For variables without a clear gold standard, Cohen's kappa was used to measure agreement. Sixty-four (5%) of the NBDPS records matched to records in the SART CORS database. NBDPS reporting of ART showed high sensitivity (92%) with use reported for all 64 mothers in the SART CORS database. NBDPS reporting of donor egg use showed sensitivity of 80% and specificity of 100%. Sensitivity of NBDPS-reported use of frozen embryos and frozen eggs was low (50% for each), but specificity was high (98% and 100%, respectively). Sensitivity for use of intracytoplasmic sperm injection (ICSI) was low (30%), but specificity was high (94.6%). There was 100% sensitivity for multiple births, with excellent agreement between the databases (kappa=0.97). NBDPS mothers accurately reported use of ART, but there was low sensitivity for reported use of several procedures, including ICSI, likely due to the lack of specific NBDPS questions.

**Cumulative live birth and time to live birth among a clinical sample of subfertile women in Utah, in relation to fertility treatments from medical records**

**Stanford JB\*, Kim J, Reeves FS, Simonsen SE, Hammoud AO  
(University of Utah, Salt Lake City, UT)**

Objective: To assess time to live birth in subfertile women from a specialized fertility clinic by linking with state birth certificates. Methods: A dataset of 4581 women seen at a University fertility clinic during 2000-2005, including records of treatment cycles of assisted reproductive technology (ART) and artificial insemination (AI), was linked to birth certificate data through 2007 by maternal name and maternal date of birth. 2,112 (46%) women's records were linked to live born infants. Cumulative probabilities of live birth and proportional hazards of live birth were calculated associated with different treatments, adjusted for women's age. Results: 40% of women who only had a consult but no ART or insemination had a live birth; whereas 64% of women who had any treatment had a live birth. As compared to no known treatment at the University fertility clinic, the use of ART and insemination, ART alone, and insemination alone were associated with a higher likelihood of having a live birth with adjusted hazard ratios of 1.7, 1.5, and 1.2, respectively. Woman's age was negatively associated with likelihood of live birth. There was no significant association between the number of treatment cycles and the probability of having a live birth. Conclusion: In this population of subfertile women, a majority had achieved a live birth over the following 2-8 years, with higher probabilities of birth among those receiving both ART and insemination at the clinic. This design does not allow investigation of other treatments that the women may have received in other settings.

**The effect of time-varying physical activity on reproductive hormones and the risk of sporadic anovulation**

**Ahrens KA\*, Vladutiu CJ, Mumford SL, Wactawski-Wende J, Schisterman EF  
(Eunice Kennedy Shriver National Institute of Child Health and Human Development,  
Bethesda, MD)**

High-intensity physical activity (PA) is associated with menstrual dysfunction and subfertility in female athletes, but the effect of PA on menstrual cycle function among more moderately active women is unclear. We evaluated the associations between intra-cyclic PA, reproductive hormones, and ovulation using data from the BioCycle Study (2005-2007), which followed 259 premenopausal, healthy women prospectively for  $\leq 2$  menstrual cycles (N=509 cycles). Serum levels of estradiol, progesterone, luteinizing hormone, follicle-stimulating hormone, testosterone and leptin were measured  $\leq 8$  times per cycle. The long-form International Physical Activity Questionnaire (IPAQ, administered at baseline) assessed habitual PA and the short-form IPAQ (administered 4 times per cycle) assessed past-week PA. Linear mixed models were used to estimate the effect of time-varying past-week PA (categorized as high, medium, and low) on hormone levels. Risk ratios for sporadic anovulation (n=42) were estimated using generalized linear models. All analyses adjusted for habitual PA, body mass index, race, age, perceived stress, and concurrent reproductive hormone levels using inverse probability weights. High past-week PA (median=68 MET hours/week) was associated with decreased leptin (-5.7%, 95% confidence interval [CI]: -10.0 to -1.3) and luteal phase progesterone levels (-18.9%, CI: -33.9 to -0.5) as compared to the low PA group (median=7 MET hours/week). We observed no statistically significant associations between past-week PA and the other reproductive hormones. High past-week PA was not associated with sporadic anovulation (risk ratio=1.4, CI: 0.6 to 3.5). Overall, intra-cyclic PA was modestly associated with selected reproductive hormones and was not observed to influence sporadic anovulation in healthy, premenopausal women.

**Fertility in female survivors of young adult cancers: The FUCHSIA Women's Study****Howards PP\*, Mink PJ, Kim KH, Chin HB, Woodard JJ, Spencer JB, Mertens AC  
(Emory University, Atlanta, GA)**

Modern cancer treatments have improved survival for young adult women after cancer diagnosis, but some treatments have ovarian-toxic effects. The degree to which these treatments prevent female survivors from meeting their reproductive goals is unknown. The FUCHSIA Women's Study recruited reproductive age (22-45 years) female survivors of young adult cancers diagnosed between ages 20-35 from the Georgia Cancer Registry (n=1243). All invasive cancers and in situ breast cancers were eligible except non-melanoma skin cancer. Comparison women (n=868) were recruited from a purchased list frequency matched on age and residence of the survivors. Approximately 39% of the survivors versus 28% of the comparison group expected to raise fewer children than they desired. At cancer diagnosis, 42% of the survivors had never been pregnant. By the interview, 31% of the survivors and 19% of the comparison group had not given birth to a child. The percent of childless survivors varied minimally (29%-32%) across treatments (radiation, chemotherapy, both, or neither). A similar proportion (16%) of survivors and comparison women reported consulting a medical professional for help getting pregnant; however, 59% of the survivors versus 66% of the comparison group who sought help actually pursued fertility treatment. Among cancer survivors who sought help, those who received radiation treatment were more likely to pursue fertility treatment (67%) and those whose cancer treatment did not include chemotherapy or radiation were less likely (57%). In Georgia, female survivors of young adult cancers are less likely to meet their reproductive goals than women who have never had cancer.

**The impact of age and nulligravidity on natural fertility in an older reproductive age cohort****Steiner AZ\*, Pritchard D, Stanford JB, Herring AH  
(University of North Carolina, Chapel Hill, NC)**

**Objective:** To examine the effect of age and nulligravidity on natural fertility **Methods:** A prospective, time-to-pregnancy cohort study of 30-44 year old women with no known history of infertility was conducted. Women (N=500), who had been trying to conceive for 3 months or less, completed a questionnaire at enrollment. They were followed without intervention until a positive pregnancy test or until censoring at 6 months of attempt. Time-to-pregnancy and fecundability ratios were determined using discrete Cox proportional hazard models. **Results:** The probability of conceiving by 6 cycles of attempt was greatest among women age 30-31 years of age (79%, 95% Confidence Interval (CI) 0.72, 0.84%, N=191) and lowest among women who were 40-43 years of age (42%, 95% CI 0.15, 0.60%, N=25). The impact of age differed by history of prior pregnancy. Women, who had previously conceived and were 38-43 years of age had 0.63 times the odds of conceiving in a given cycle compared to their younger counterparts. However, nulligravid women ages 38-43 had only 0.13 times the odds of conceiving in a given cycle compared to their younger counterparts (FR 0.13, 95% CI 0.02, 0.92). A prior pregnancy was a stronger predictor of fecundability among the older women (FR 6.42) than among the younger women (FR 1.31, 95% CI 1.03, 1.66). **Conclusions:** Natural fertility declines with age. The impact of aging is greatest among nulligravid women; however, this could be attributable to the movement of women out of the nulligravid group upon achieving a pregnancy, selecting out the more fertile and leaving the less fertile in the remaining nulligravid group.

**Comparing fertility treatment success between young adult cancer survivors and women who have not had cancer: The FUCHSIA Women's Study****Knight JH\*, Chin HB, Kim KH, Hartnett KP, Spencer JB, Howards PP  
(Epidemiology Department, Rollins School of Public Health, Emory University, Atlanta, GA)**

Some cancer survivors experience difficulty becoming pregnant as a result of their cancer treatment and consequently pursue assisted reproductive technology. However, it is unclear whether the success rates of fertility treatments differ in cancer survivors compared with women who experience decreased fertility for other reasons. The FUCHSIA Women's Study interviewed young female cancer survivors and comparison women (ages 22-45). Approximately 16% of comparison women (n=114) visited a doctor for help becoming pregnant at a mean age of 30, and 66% of these women then pursued fertility treatment. Similarly, 16% of the cancer survivors (n=198) sought help becoming pregnant at a mean age of 30; 50% prior to cancer diagnosis (mean age = 27), 44% after (mean age = 32), and 6% before and after. Among those seeking help prior to cancer diagnosis, 68% pursued fertility treatment in contrast to 60% of those seeking help after cancer diagnosis. Treatment methods did not vary significantly by group. Half of the cancer survivors using artificial intrauterine insemination (IUI) before cancer treatment achieved a pregnancy lasting at least 20 weeks compared with 42% of cancer survivors using IUI after diagnosis and 30% of comparison women using IUI. Among women using hormones or medications to achieve pregnancy, comparison women had the most 20 week pregnancies (49%), followed by women treated after cancer diagnosis (44%) and then women treated before cancer diagnosis (41%). If differential pregnancy success rates are associated with health history, then fertility treatments could emphasize methods most successful according to the woman's health.

**The effect of paternal obesity on in vitro fertilization outcomes**

**Schliep KC\*, Mumford SL, Link M, Carrell DT, Hammoud AO**  
**(Eunice Kennedy Shriver National Institute of Child Health and Human Development,**  
**Bethesda, MD)**

Paternal obesity has been linked to decreased semen quality but effects on in vitro fertilization (IVF) outcomes are inconclusive. We performed a retrospective cohort study of all couples (n=735) undergoing fresh IVF cycles from 2005-2010 at the Utah Center for Reproductive Medicine restricting to first treatment cycles. We assessed the relationship between self-reported body mass index (BMI) and odds of pregnancy and live birth using chi-square and, for adjusted analyses, multivariate logistic regression. 395 (53.7%) couples achieved pregnancy and 355 couples (48.3%) had a live birth. Overweight males (BMI 24.9-29.9) showed the highest pregnancy prevalence (56.6%), followed by obese class I (BMI 29.9-34.9; 56.6%), obese class II/III (BMI  $\geq$ 35.0; 50.9%), and normal weight (18.5-24.9; 49.6%), (P=0.41). A similar trend was found for live births. Odds of pregnancy (odds ratio (OR)=0.95; 95% confidence interval (CI): 0.77, 1.17) and live birth (OR=1.00; 95% CI: 0.81, 1.22) were not associated with paternal BMI, after adjusting for male age, female age, female BMI (measured in clinic prior to treatment), previous pregnancy, number of oocytes retrieved, and infertility diagnosis. Results were similar when stratifying on whether couple received traditional IVF or intracytoplasmic sperm injection. In summary, paternal obesity was not associated with reduced pregnancy or live birth. Our study was the largest study to date (previous studies having between 114-305 couples); however was limited by self-reported male height and weight. Further research that is adequately powered is needed before definitive conclusions can be made.

**The effect of serum leptin levels on reproductive hormones and the risk of sporadic anovulation**

**Ahrens KA\*, Mumford SL, Schliep KC, Kissel KA, Perkins NJ, Wactawski-Wende J, Schisterman EF**  
(Eunice Kennedy Shriver National Institute of Child Health and Human Development, Bethesda, MD)

Leptin, an adipose-derived hormone, may be involved in regulating the menstrual cycle. We investigated the role of leptin in the menstrual cycle using data from the BioCycle Study (2005-2007), which followed 259 premenopausal, healthy women not using hormonal contraceptives prospectively for  $\leq 2$  menstrual cycles (N=509 cycles). Serum levels of estradiol, progesterone, luteinizing hormone (LH), follicle-stimulating hormone (FSH), testosterone and leptin were measured  $\leq 8$  times per cycle. The effect of time-varying leptin concentration on reproductive hormones over the cycle was estimated using linear mixed models adjusted for percent body fat, race, age and other time-varying hormones using inverse probability of exposure weighting. Generalized linear models were used to estimate the adjusted risk ratio for sporadic anovulation (n=42) by leptin level. Average serum leptin levels increased over the menstrual cycle (from 16.6 to 20.5 ng/mL), with a mid-cycle peak immediately before the expected time of ovulation (21.8 ng/mL); anovulatory cycles displayed lower leptin levels during the ovulatory ( $p < 0.01$ ) and luteal phases ( $p < 0.01$ ). A 10% higher leptin concentration was associated with higher estradiol (3.7%, 95% confidence interval [CI]: 2.9 to 4.6), testosterone (1.1%, CI: 0.8 to 1.3), luteal phase progesterone (1.8%, CI: 0.4 to 3.3) and ovulatory phase LH concentrations (1.3%, CI: 0.3 to 2.3), and lower FSH concentration (-1.0%, CI: -1.5 to -0.5). High leptin levels ( $> 85$ th percentile) were not observed to be significantly associated with sporadic anovulation (adjusted risk ratio=0.3, 95% CI: 0.06 to 1.7). These findings suggest that leptin may be closely tied to menstrual cycle cyclicity and function.

**Sexual activity and its effect on endogenous reproductive hormones and ovulation**

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Many mammals exhibit reflex ovulation, where sexual activity triggers ovulation. However, relationships between sexual activity and reproductive hormone levels in women are unclear. The BioCycle Study followed 259 women aged 18-44 for  $\leq 2$  cycles, who were not attempting pregnancy or using hormonal contraception. Sexual activity, defined as vaginal intercourse, was self-reported via a daily diary. Outcomes included sporadic anovulation and serum concentrations of estradiol, progesterone, luteinizing hormone (LH), follicle-stimulating hormone (FSH), and testosterone measured  $\leq 8$  times/cycle. No sexual activity was reported by 124 (47.9%) women and 135 (52.1%) reported having sex at least once over the two cycles. Women reporting sex  $\geq 1$ /cycle had a lower proportion of anovulatory cycles compared to women reporting no sexual activity (3.4% v. 10.7%,  $p=0.002$ ). Generalized linear models were used to estimate effects of sexual activity on ovulation while linear mixed models were used to estimate time-varying effects of sexual activity on hormones throughout the cycle. Models were adjusted for age, race, body mass index, perceived stress and alcohol consumption. Reported sexual activity prior to the time of ovulation was associated with decreased odds of sporadic anovulation (odds ratio 0.38, 95% confidence interval: 0.14-1.0). Time-varying reported sexual activity did not appear to be associated with hormone levels across the menstrual cycle. Sexual activity was associated with a lower probability of anovulation, suggesting a possible correlation between sexual activity and ovulation in humans.

**Infertility treatments and postpartum depressive symptoms in Massachusetts**

**Stone SL\*<sup>a</sup>, Diop H<sup>b</sup>, Eugene Declercq E<sup>c</sup>, Cabral HJ<sup>d</sup>, Wise LA<sup>a,e</sup>**  
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**of Public Health, Department of Community Health Services, Boston MA; <sup>d</sup>Boston**  
**University School of Public Health, Department of Biostatistics, Boston, MA; <sup>e</sup>Slone**  
**Epidemiology Center, Boston University, Boston, MA)**

**BACKGROUND:** The impact of successful infertility treatment (IFT) on the prevalence of postpartum depressive symptoms (PDS) is uncertain. **METHODS:** We used the Massachusetts Pregnancy Risk Assessment Monitoring System (PRAMS) 2007-2010 data to evaluate whether IFT was associated with early PDS and subsequent help-seeking behaviors. We categorized IFTs into 3 groups: fertility-enhancing drugs (FD), donor insemination or intrauterine insemination (DI/IUI), and assisted reproductive technology (ART) including in vitro fertilization. We defined PDS as report of 'always' or 'often' to any depressive symptoms; reference group reported 'sometimes', 'rarely' or 'never' to all depressive symptoms. Modified Poisson regression models directly estimated prevalence ratios (PRs) and 95% confidence intervals (CIs), controlling for socioeconomic status indicators and prior mental health visits. **RESULTS:** Among 3,509 participants in PRAMS during 2007-2010 who wanted pregnancy, 11.7% reported any IFT (FD=6.0%, DI/ IUI=2.6%, ART=4.9%, weighted using SUDAAN). Reported IFT was not associated with an appreciable increase in prevalence of PDS (PR=1.13, 95% CI 0.78-1.63). Grouped IFTs also showed no material increase in prevalence of PDS: FD PR=1.14 (95% CI 0.58-2.24), DI/IUI PR= 1.16 (95% CI 0.47-2.85), ART PR=0.82 (95% CI 0.41-1.62). Among those with PDS, there was little evidence that any type of IFT predicted help-seeking behavior. **CONCLUSIONS:** IFT was not associated with increased prevalence of early PDS. Moreover, IFT did not predict help-seeking behavior among women with PDS. While reassuring women that IFT does not increase prevalence of PDS, all mothers should be continuously screened postpartum and encouraged to seek help for effective primary prevention of PDS.

**Stressful events during pregnancy and postpartum depressive symptoms in Massachusetts**

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**Epidemiology Center, Boston University, Boston, MA)**

**BACKGROUND:** The influence of perinatal stressors on the risk of postpartum depressive symptoms (PDS) is uncertain. We investigated the association between perinatal stressors and prevalence of PDS. **METHODS:** We used the Massachusetts Pregnancy Risk Assessment Monitoring System (PRAMS) 2007-2010 data to evaluate whether perinatal experiences of selected stressors were associated with PDS and with subsequent help-seeking behaviors. We categorized 12 stressors into 4 groups: partner, trauma, financial and emotional. We defined PDS as report of 'always' or 'often' to any depressive symptoms; reference group reported 'sometimes', 'rarely' or 'never' to all depressive symptoms. Modified Poisson regression models directly estimated prevalence ratios (PRs) and 95% confidence intervals (CIs), controlling for socioeconomic status indicators, pregnancy intention and prior mental health visits. **RESULTS:** Among the 5,375 participants in PRAMS during 2007-2010, 59% reported  $\geq 1$  stressor (partner=26%, traumatic=16%, financial=29% and emotional=30%, weighted using SUDAAN). Report of  $\geq 1$  stressor was associated with an increased prevalence of PDS (PR=2.77, 95% CI 2.18-3.50). The strongest associations were observed for partner stress (PR=2.74, 95% CI 2.01-3.75), then traumatic (PR=1.83, 95% CI 1.17-2.88), financial (PR=1.83, 95% CI 1.31-2.60) and emotional (PR=1.44, 95% CI 1.02-2.03). Among those with PDS, there was little evidence that any type of stressor predicted help-seeking behavior. **CONCLUSIONS:** Life stressors during pregnancy were associated with increased prevalence of PDS; however, life stressors did not appreciably predict help-seeking behavior among women with PDS. Women should be screened during the perinatal period for stressors, and should be encouraged to seek help for effective primary prevention of PDS.

**Birth outcomes following a first-born male in an ethnically diverse California population****Bruckner TA\*, Catalano R**  
(University of California, Irvine)

Research from Scandinavia finds that a giving birth to a first-born male predicts lower birthweight and increased risk of preterm in the subsequent birth. The relevance of the Scandinavian findings to the US, however, remains unclear given the divergent racial/ethnic characteristics of these regions. We use a unique dataset of almost 200,000 mothers, with birth data linked across pregnancies, to test the male virulence hypothesis. Using linked files from California's Genetic Disease Screening Program, we acquired birth data from mothers who delivered consecutive, singleton live births from 2002 to 2007. We estimated the association between male first-born sex and two outcomes: birthweight (using linear regression) and preterm delivery (<37 weeks; using logistic regression). Analyses controlled for interbirth interval, maternal age, sex of second-born offspring, and all other maternal factors that do not vary across the first and second pregnancy. We find support for the male virulence hypothesis in that a first born male varies inversely with the subsequent birth's weight (coef: -22.43 gm, 95% Confidence Interval [CI] = -26.9 to -17.9 gm), but positively with the risk of preterm delivery (OR = 1.12, 95% CI = 1.07 to 1.17). Analyses by racial/ethnic subgroups, however, indicate substantial variation. Non-Hispanic white and Hispanic mothers show associations similar in direction and magnitude to the overall estimates, but non-Hispanic blacks show a null relation. Findings in California support the male virulence hypothesis for some, but not all, race/ethnicities.

**Associations of diet and physical activity with the 3 components of gestational weight gain****Wen X\*, Justicia-Linde FE, Kong K, Zhang C, Chen W, Epstein LH, Rifas-Shiman SL, Tian F, Gillman MW****(Division of Behavioral Medicine, Department of Pediatrics, School of Medicine and Biomedical Sciences, State University of New York at Buffalo, Buffalo, NY)**

Objective: To examine effects of diet and physical activity (PA) on the 3 components (fetus, placenta, and maternal weight gain) of gestational weight gain (GWG). Methods: We analyzed a sub-sample (N=852) of Project Viva, a pre-birth cohort in Massachusetts. Pregnant women self-reported their diet at 1st (Tri1) and 2nd trimester (Tri2) and physical activity at Tri2. We calculated maternal weight gain by subtracting measured fetal and placental weight at delivery from total GWG. We fitted multivariable linear regression models for internal z-scores of 3 GWG components, adjusting for maternal age, race/ethnicity, parity, prepregnancy body mass index, energy intake (for nutrients), and the child's sex and gestational age. Results: Tri2 energy intake was positively associated with maternal weight gain (mean difference in weight z-score per 500 kcal/day increment in energy intake, 0.11 [95% confidence interval, 0.05 to 0.17]) but not with fetal or placental weight, whereas Tri2 PA (-0.29 [-0.43,-0.15] per 10 minutes/day) was inversely associated. The percentage of energy from protein during Tri1 (0.15 [0.02,0.28] per 10 percent) and polyunsaturated fat during Tri2 (0.25 [0.01,0.49]) were positively associated with maternal weight gain, but that from other fatty acids or carbohydrates was not associated. Vegetarian diet during Tri2 was associated with lower fetal (-0.39 [-0.71,-0.08]) and placental weight (-0.40 [-0.79,-0.01]), but not with maternal weight gain. Conclusion: In our sample, lower energy intake and higher PA during mid-pregnancy might reduce maternal weight gain without impacting fetal and placental weight. In contrast, vegetarian diet during mid-pregnancy seems to specifically restrict fetal and placental growth.

**Maternal obese, vitamin D status and risk of preeclampsia**

**Wei S\*, Luo Z, Fraser WD, and the MIROS study group**  
**(Department of Obstetrics and Gynecology, Sainte-Justine Hospital, University of Montreal, Quebec, Canada)**

Objective: To examine the associations between maternal plasma levels of 25-hydroxyvitamin D [25(OH)D] and pre-pregnancy body mass index (BMI) and the risk of preeclampsia. Study design: This is a prospective cohort study of 697 pregnant women. Maternal plasma 25(OH)D levels were measured at 12-18 weeks and 24-26 weeks of gestation using chemiluminescence immunoassay. Results: In all, 18% of pregnant women were obese ( $BMI \geq 30$ ). Forty percent had plasma 25(OH)D levels less than 50nmol/l. Maternal plasma 25(OH)D levels at 12-18 weeks and 24-26 weeks gestation were inversely associated with pre-pregnancy BMI (at 12-18 weeks gestation:  $r = -0.223$ ,  $p < .0001$  ; at 24-26 weeks gestation:  $r = -0.182$ ,  $p < .0001$  ; respectively). Compared to non-obese women, obese women had higher prevalent rate of low vitamin D status [25(OH)D less than 50 nmol/L] (at 12-18 weeks gestation: 54.2% vs. 35.0%,  $p < .0001$ ; at 24-26 weeks gestation :50.9% vs.34.3%,  $p = .0001$  ; respectively). Pregnant women who developed preeclampsia had higher mean BMI compared those who did not ( $28.0 \pm 7.0$ , 25.6 vs.  $25.1 \pm 5.6$ , 23.5,  $p = 0.02$ ). Interestingly, non-obese women with 25 (OH) D  $< 50$  nmol/L at 24-26 weeks gestation experienced a marked increase in the risk of preeclampsia (aOR 4.33, 95% CI 1.53-12.24). However, for obese women, there was no statistical evidence of such an association (aOR 1.63, 95% CI 0.35-7.57). Conclusion: Maternal obesity is associated with an increased prevalence of vitamin D deficiency during pregnancy. The association between maternal low vitamin D status during pregnancy and preeclampsia was only in non-obese women.

**Surveillance of the 'missing half': Formative research to determine the acceptability of a PRAMS-like survey among women who have recently experienced a stillbirth****Christiansen-Lindquist L\*, Sahay K, Gaydos L, Hogue C  
(Emory University, Atlanta, GA)**

Roughly one-half of U.S. fetal and infant deaths from 20 weeks' gestation to one year occur as stillbirths, and stillbirth mortality has not decreased substantially since the 1980s. Since 1987, CDC and state health departments have used the Pregnancy Risk Assessment Monitoring System (PRAMS) to survey women with a recent live birth. Expanding PRAMS to include women with recent stillbirths could provide much-needed surveillance data. Eligible women can be identified through vital records, utilizing methodologies similar to those already employed by PRAMS. It is unknown whether bereaved mothers would be amenable to a PRAMS-like interview and whether the protocol requires modification for this population. In partnership with CDC's Division of Reproductive Health, we interviewed stillbirth advocacy leaders (N=10) and women who experienced a recent stillbirth (N=11) to explore whether bereaved mothers would be willing to answer survey questions about their experiences. Respondents strongly supported the implementation of a PRAMS-like survey for stillbirth, citing both scientific and emotional benefits. While there was no consensus on when to administer the survey relative to the loss, most women thought that waiting 3-4 months post-loss would be appropriate. Some expressed concerns regarding aggressive follow-up during this time of grief. Given the positive response, CDC will pilot this survey in 2-3 states in the coming year. If successfully implemented, this state-based surveillance system for stillbirth can provide women's health advocates, public health policy makers, and private healthcare providers with current information to use for healthcare quality improvement leading to a reduction in stillbirths.

**The effect of maternal psychiatric illness on length of gestation**

**O'Loughlin JA\*, Laughon SK, Mendola P, Mannisto T, Xie Y, Chen Z, Werder E, Ehrental D, Kiely M**  
**(Eunice Kennedy Shriver National Institute of Child Health and Human Development, Bethesda, MD)**

Psychiatric illness, and in particular depression, may increase risk of preterm birth (PTB), but less is known about other disorders. We investigated the association of psychiatric illness and length of gestation in a retrospective U.S. cohort of 193,071 women with 211,194 singleton deliveries. Psychiatric disorders were defined using hospital discharge diagnoses and medical record data. Gestational age at delivery was explored using a fetus-at-risk model for delivery dichotomized at 28, 34 and 37 weeks. Adjusted odds ratios (OR) and 95% confidence intervals (CI) were calculated using logistic regression and generalized estimating equations adjusting for maternal age, body mass index, insurance, smoking, race, marital status, substance use, alcohol, parity, chronic disease and site. Psychiatric disorders complicated 25% of pregnancies with the following distribution: depression 12.4%, anxiety 0.3%, bipolar/manic depression 0.2%, depression with anxiety 0.2%, bipolar with depression/anxiety 0.2%, schizophrenia 0.1%, and psychiatric disorder in pregnancy not otherwise specified 11.6%. All psychiatric disorders except schizophrenia were associated with an increased risk of PTB < 37 weeks: depression OR=1.16 (95% CI: 1.11-1.20), anxiety OR=2.41 (95% CI: 1.97-2.94), bipolar/manic depression OR=1.57 (95% CI: 1.23-2.01), depression with anxiety OR=1.73 (95% CI: 1.32-2.25), bipolar with depression/anxiety OR=1.62 (95% CI: 1.25-2.09), schizophrenia OR=0.95 (95% CI: 0.55-1.63), and psychiatric not otherwise specified OR=1.53 (95% CI: 1.47-1.59). Most disorders remained significantly associated with PTB < 28 and < 34 weeks. Our findings suggest that psychiatric illnesses, especially anxiety and disorders with anxiety comorbidity, were a risk factor for preterm birth and should be a target for future interventions.

**Effect of fine particles and its constituents on term low birth weight in California**

**Basu R\*, Harris M, Sie L, Malig B, Broadwin R, Green R**  
**(California Environmental Protection Agency, Office of Environmental Health Hazard Assessment, Oakland CA)**

Previous studies have described associations between prenatal exposure to fine particles (PM<sub>2.5</sub>) and low birth weight (LBW; <2,500 grams). Very few studies have considered the constituents of PM<sub>2.5</sub>. By examining PM<sub>2.5</sub> constituents, potential sources and major contributors of risk may be identified. We examined the effects of prenatal exposure PM<sub>2.5</sub> total mass and 23 PM<sub>2.5</sub> constituents on birth weight among term births. We estimated trimester and full gestational exposures of PM<sub>2.5</sub> mass and PM<sub>2.5</sub> constituents for a cohort of 650,850 births occurring in California within 20 kilometers of one of eight PM<sub>2.5</sub> constituent monitors between 2000 and 2006. We used linear and logistic regression models to assess associations between exposures and term birth weight and percent increase in risk of term LBW, respectively. Models were adjusted for region: Northern/Central Valley and Southern California and for individual demographic characteristics, zip code level socioeconomic indicators, apparent temperature during pregnancy, and month and year of birth. PM<sub>2.5</sub> mass and several PM<sub>2.5</sub> constituents were significantly associated with term LBW for full pregnancy exposures. PM<sub>2.5</sub> mass and nearly all PM<sub>2.5</sub> constituents appeared to be significantly associated with a reduction in term LBW and increase in risk of term LBW for full pregnancy exposure. The largest reductions were observed for vanadium, sulfur, sulfate, iron, titanium, elemental carbon, zinc, iron, copper, ammonium, and bromine. Effects tended to be larger among younger mothers and White mothers. Exposure to specific constituents of PM<sub>2.5</sub>, especially traffic-related particles, sulfur species, and metals, were associated with increased risk of LBW in California.

**Sleep disorders and diabetes in pregnant and non-pregnant women of childbearing age****Xiong X\*, Xie Y, Buekens P****(Tulane University School of Public Health and Tropical Medicine, New Orleans, LA)**

Literature suggests an association between sleep disorders and diabetes mellitus. The authors sought to examine the association between sleep disorders and diabetes in pregnant and non-pregnant women. We conducted a secondary analysis based on self-reported health and sleep characteristics collected by the National Health and Nutrition Examination Survey (NHANES) from 2005 to 2010. The present study sample included 507 pregnant women and 3,875 non-pregnant women aged 15-44 years. Univariate and multivariate logistic analyses were performed to examine the association between sleep disorders and diabetes and to adjust for age, ethnicity, smoking, body mass index, and other confounding variables. The overall prevalence of having trouble sleeping, sleep disorders (e.g., sleep apnea and insomnia), and daily sleep < 7 hours was 23.5%, 7.0%, and 29.0% in pregnant women; and 21.9%, 6.7%, and 37.7% in non-pregnant women. In pregnant women, women who had trouble sleeping and daily sleep < 7 hours were not at increased risk of having diabetes, with adjusted odds ratio (aOR) of 0.3 [95% confidence interval (CI): 0.1-0.9] and 0.3 (0.1-1.3). In non-pregnant women, women who had trouble sleeping, sleep disorders, and daily sleep < 7 hours were also not at increased risk of having diabetes, with aOR of 1.2 (0.8-1.9), 1.7 (0.8-3.3), and 1.0 (0.7-1.3), respectively. The authors conclude that sleep disorders are not associated with an increased risk of diabetes in women of childbearing age.

**Identifying maternal deaths for maternal mortality review - issues of timeliness and completeness****Berg CJ\*, Goodman D, Freymann G, Callaghan WM  
(CDC, Atlanta, GA)**

Identification of potential maternal deaths begins the maternal mortality review process. Increasingly, states want to review cases in a timely fashion. We compared three methods of case identification in terms of timeliness, completeness and accuracy of ascertainment. In 2010, we received all 2010 death certificates for women aged 10-50 that linked to birth/fetal death certificates for the year before the death, plus death certificates for which the pregnancy checkbox indicated death during pregnancy or the following year, from the Georgia Office of Vital Records. In 2012, we received all 2010 Georgia death certificates with ICD-10 cause-of-death codes assigned by NCHS and sent to the Georgia Office of Health Indicators for Planning. We included all deaths identified by linkage, checkbox or ICD-10 Chapter-O codes (indicating pregnancy) in our analysis. Four experienced clinicians reviewed all death certificates and categorized them as caused by pregnancy complications (maternal), other medical conditions, suicide, drug overdose, homicide or motor vehicle crashes. Linkage identified 81 deaths within a year of pregnancy; 29 were maternal deaths. The checkbox identified 53 deaths within a year of pregnancy; 33 were maternal. Of 55 deaths with O-codes, 36 were maternal, 17 non-maternal. Twelve maternal deaths did not have an O-code and three were found by O-code only. Linkages and checkboxes, which can be done by the states in real-time, identified over 90% of maternal deaths and can be used immediately by maternal mortality review committees. Waiting for ICD coding substantially delays identification and, used alone, both over- and under-identifies cases.

**Predictors of hospitalization for cardiovascular disease, stroke, and diabetes in the year following delivery in New York State, 1995-2004****Savitz DA\*, Danilack V, Elston B, Lipkind H  
(Brown University, Providence, RI)**

There is increasing awareness that pregnancy constitutes a 'stress test' that predicts future chronic disease. Clinical events typically occur many years later as women age, but using a very large database (over 2.3 million births), we were able to examine the relationship between maternal characteristics and pregnancy conditions in relation to inpatient diagnoses within the first year following delivery. Based on hospital discharge data for upstate New York and linked hospitalization and birth certificate data for New York City, we examined sociodemographic characteristics and pregnancy complications as predictors of coronary heart disease, heart failure, intracranial hemorrhage, stroke, deep vein thrombosis, and diabetes. With few exceptions of deep vein thrombosis these conditions increased over calendar time, with advancing age, with increasing prepregnancy weight (available only for New York City births), and were elevated in Blacks compared to whites. Preeclampsia was strongly associated ( $OR > 2.0$ ) with risk of coronary heart disease, stroke, deep vein thrombosis, and diabetes, and showed a very strong relationship with heart failure (adjusted  $OR = 8.5$ , 95%  $CI = 6.3-11.4$  for upstate New York and 4.7 (3.3-6.6) for New York City). Associations for gestational hypertension were modestly weaker and less consistent than those for preeclampsia. Gestational diabetes was very strongly predictive of diabetes hospitalization ( $OR > 25$ ). Hypertensive disorders of pregnancy in particular predict short-term risk within a year of delivery, identifying a group that might be targeted for increased integration into primary care and possible preventive interventions.

**Genome-wide association, candidate gene, and pathway analysis studies of placental abruption**

**Workalemahu T\***, Enquobahrie DA, Sanchez SE, Ananth CV, Pacora P, Liang L, Williams MA  
(Harvard School of Public Health, Boston, MA)

Background: Placental abruption (PA), a leading cause of maternal and perinatal mortality, is a pregnancy-related vascular disorder. The success of identifying susceptibility loci for PA, a complex multi-factorial disease with high heritability, has been limited. Methods: We conducted a genome-wide association study (GWAS) using 470 PA cases and 473 controls from Lima, Peru. We also performed a candidate gene association study to evaluate the extent to which variations in 35 genes that participate in mitochondrial biogenesis (MB) and oxidative phosphorylation (OP) influence PA risk. Variants in cardiovascular and metabolism genes, across the genome, were characterized using ~125,000 single nucleotide polymorphisms (SNPs) on the Illumina Cardio-Metabo Chip. We examined functions and functional relationships of genes represented by the top 200 hits from our GWAS using pathway-based analyses exploring joint effects of gene sets within specific pathways. Results: The top hit in our GWAS study was rs1238566 (p-value=1.04e-4) in FLI-1 gene, a megakaryocyte-specific transcription factor. In pathway analyses of 51 genes represented by the top 200 GWAS hits (p-values <2.1e-3), leading networks were enriched by genes involved in lipid metabolism (e.g., FLI-1, CETP, LIPC, and THRB) and cell signaling (e.g., Akt, NFKB, and PI3K). In candidate gene analyses, SNPs in genes in MB (e.g. CAMK2B, NR1H3, PPARG, PRKCA, and THRB) or OP (e.g., COX5A, and NDUF family of genes) pathways were significantly associated with PA. Conclusion: Integrating different genomic analytical strategies provides opportunities for identifying novel biological pathways for exploring underlying molecular mechanisms for PA.

**Interaction between maternal passive smoking during pregnancy and CYP1A1 and GSTT1 polymorphisms on full term low birth weight****Chen W<sup>1\*</sup>, Ding P<sup>1</sup>, Wen X<sup>2,3</sup>, Zhang C<sup>1</sup>, Luo Y<sup>1</sup>, Yuan S<sup>4</sup>, Guo X<sup>5</sup>****(<sup>1</sup>Department of Medical Statistics and Epidemiology, School of Public Health, Sun Yat-sen University, Gaungzhou, China; <sup>2</sup>Division of Behavioral Medicine, Department of Pediatrics, School of Medicine and Biomedical Sciences, State University of New York at Buffalo, Buffalo, NY; <sup>3</sup>Department of Social and Preventive Medicine, School of Public Health and Health Professions, State University of New York at Buffalo, Buffalo, NY; <sup>4</sup>Shenzhen Women and Children's Hospital, Shengzhen, Foshan, China)**

Objectives: To examine interactions between maternal passive smoking during pregnancy and CYP1A1 and GSTT1 polymorphisms on risk of full term low birth weight (LBW). Methods: We conducted a case-control study among 233 Chinese women with the full term LBW and 677 with normal births in Guangdong, Southern China. Maternal self-report and serum cotinine concentration (3 ng/ml) were combined to define maternal passive smoking during pregnancy. The single nucleotide polymorphisms of CYP1A1 M1 (TT, TC, CC), CYP1A1 M2 (AA, AG, GG), and GSTT1 (null vs. present) were tested by PCR-RFLP sequencing approaches. Logistic regression model was used to test gene-environmental interactions, adjusting for maternal age, occupation, education, pre-pregnancy body weight, and family income. Results: Passive smoking during pregnancy was associated with higher risk of full term LBW (adjusted odds ratio, 2.27 [1.68-3.09]). We found two-way interactions between passive smoking and CYP1A1 M1 CC (5.83 [1.79-19.00]; vs. CYP1A1 M1 TT) or GSTT1 null (5.24 [2.72-10.09]; vs. GSTT1 present), on risk of full term LBW. There were also two-way interactions between CYP1A1 M1 TC or CC and GSTT1 null. We also found three-way interactions among passive smoking, CYP1A1 M1 TC (5.83 [1.79-19.00]), and GSTT1 null (6.00 [1.52-23.61]; vs. CYP1A1 M1 TT). Similar, there were three-way interaction among passive smoking, CYP1A1 M2 AG (9.54 [2.32-39.28]; vs. CYP1A1 M2 AA) or CYP1A1 M2 GG (114.73 [4.45-2414.29]; vs. CYP1A1 M2 AA), and GSTT1 null. Conclusion: In our sample, maternal passive smoking during pregnancy interacted with maternal CYP1A1 and GSTT1 genotypes on risk of full term LBW.

**Does the female fetus affect insulin resistance in the mother?**

**Xiao L\*, Zhao JP, Nuyt AM, Fraser WD, Luo ZC**  
(CHU Sainte-Justine, University of Montreal, Montreal, Canada)

Substantial evidence indicates that girls are more insulin resistant than boys in utero, but whether the female fetus may affect insulin resistance in the mother is unknown. In a prospective singleton pregnancy cohort (n=299), we explored maternal insulin resistance by fetal sex, based on maternal plasma glucose and insulin concentrations in the 50 g oral glucose tolerance test (OGTT) blood at 24-28 weeks gestation. Comparing women bearing a female vs. male fetus, maternal OGTT blood insulin concentrations were significantly higher (mean-SD: 71.7-64.8 versus 51.0-46.1 mU/L,  $p=0.02$ ), despite similar glucose levels (mean-SD: 116.4-27.2 versus 117.0-32.0 mg/dL). Glucose-to-insulin ratio was significantly lower in women bearing a female fetus (2.6-2.0 versus 4.6-9.3 mg/dL/mU/L,  $p=0.003$ ). The differences by fetal sex in maternal plasma insulin concentration ( $p=0.001$ ) and glucose-to-insulin ratio ( $p=0.001$ ) remained significant after adjusting for maternal characteristics (body mass index, age, ethnicity, education, parity, smoking and alcohol use). The preliminary data indicate that the female fetus may increase maternal insulin resistance, consistent with some previous reports of greater secretion of certain placenta-derived insulin antagonist hormones in women bearing a female versus male fetus.

**Association of glucose levels in pregnancy with use of health care services**

**Vesco KK, Sharma AJ\*, England LJ, Callaghan WM, Bruce FC, Kimes T, Bulkley JE, Hornbrook MC**  
**(The Centers for Disease Control and Prevention, Atlanta, GA)**

Newly recommended gestational diabetes (GDM) test cut-points are lower, and diagnosis requires only one, rather than two, abnormal value; hence, GDM diagnoses will increase. We sought to determine whether pregnancy health care use varies according to severity of GDM test results. We conducted a retrospective cohort study among 32,852 women enrolled in Kaiser Permanente Northwest with singleton births (1999-2008) at >28 weeks gestation who completed GDM screening. Categories, based on 1-hour, 50-gram glucose challenge tests (GCT) and 3-hour, 100-gram oral glucose tolerance tests (OGTTs), were ranked by increasing severity of glycemia: GCT<140 (referent, n=27,944), normal OGTT by Carpenter & Coustan [CC] and National Diabetes Data Group [NDDG] (n=2,484), 1 abnormal OGTT value by CC (n=555), 2 abnormal OGTT values by CC (n=163), 2 abnormal OGTT values by CC and 1 abnormal by NDDG (n=390), 1 abnormal by NDDG (n=502), 2 abnormal by NDDG or >200 on GCT (diagnosed GDM, n=814). Utilization measures included diabetes medication and testing supplies dispensing, ultrasounds, and invasive and noninvasive antenatal tests. Analyses were age- and BMI-adjusted and accounted for correlated data. Increasing levels of glucose test abnormality were associated with increased dispensing of diabetes medications (range: 0% to 8%) and supplies (0% to 93%), and, on average, greater numbers of obstetrical ultrasounds (1.2 to 2.3) and invasive (0.05 to 0.11) and noninvasive tests (1.6 to 3.2); p-for-trend <0.0001 for all. Lowering cut-points for GDM diagnosis may result in increased health care use and costs. The potential health benefits need further study.

**Examining the effect of time-dependent ecologic dengue exposure by trimester****Friedman EE \*<sup>1</sup>, Harville EW<sup>1</sup>, Buekens P<sup>1</sup>, Thomashek K<sup>2</sup>, Rivera A<sup>2</sup>, Johansson M<sup>2</sup>, Llovet Diaz W<sup>3</sup>, Viera Maldonado Y<sup>3</sup>****(<sup>1</sup>Department of Epidemiology, Tulane School of Public Health and Tropical Medicine, New Orleans, LA; <sup>2</sup>CDC Dengue Branch, San Juan Puerto Rico; <sup>3</sup>Department of Vital Records, San Juan Puerto Rico)**

Data on dengue infection and its possible effects on the developing fetus are scarce. Existing data have suggested higher rates of preterm birth and low birth weight in infants born to mothers infected with dengue during pregnancy. This study is a semi-ecologic examination of birth outcomes for infants born in Puerto Rico who were in utero during periods of dengue transmission. Outcomes of preterm birth (PTB), low birthweight (LBW), and small for gestational age (SGA) were investigated using logistic regression. Cumulative ecologic exposure to dengue is defined as the number of confirmed cases occurring island wide during each infant's gestational period. Each additional case of dengue was associated with increased risk of PTB in infants for the first (adjusted OR (aOR) = 1.041 (95% confidence interval, 1.035, 1.047)), second (aOR = 1.036 (1.030, 1.040)), and third trimesters (aOR = 1.014 (1.004, 1.024)). Each additional case of dengue was associated increased risk of LBW for the first (aOR = 1.019 (1.012, 1.027)) and second trimesters (aOR = 1.023 (1.014, 1.031)), while a protective effect was seen for the third trimester (aOR = 0.889 (0.881, 0.897)). Protective effects were seen for SGA for the first (aOR = 0.994 (0.987, 1.001), and second trimesters (aOR = 0.999 (0.990, 1.007)) while an increase in risk was seen in the third trimester (aOR= 1.034 (1.028, 1.040)). the clinical significance of these findings is unknown, since the magnitude of the effect s were small. Individual level analyses will be required to confirm these findings.

**An ecologic level examination of the relationship between dengue and poor birth outcomes****Friedman EE \*<sup>1</sup>, Harville EW<sup>1</sup>, Buekens P<sup>1</sup>, Thomashek K<sup>2</sup>, Rivera A<sup>2</sup>, Johansson M<sup>2</sup>, Llovet Diaz W<sup>3</sup>, Viera Maldonado Y<sup>3</sup>****(<sup>1</sup>Department of Epidemiology, Tulane School of Public Health and Tropical Medicine, New Orleans, LA; <sup>2</sup>CDC Dengue Branch, San Juan Puerto Rico; <sup>3</sup>Department of Vital Records, San Juan Puerto Rico)**

Previously reported risks for women who are pregnant and contract dengue include an increased risk of preterm labor. Symptomatic dengue infection could result in preterm birth by inflammatory cytokine release and fever. We examined the possible relationship between dengue virus infections and poor birth outcomes in Puerto Rico at the ecologic level. Using time series methods the relationship between dengue and the poor birth outcomes of preterm birth (PTB), low birthweight (LBW), and small for gestational age (SGA) were analyzed. The outcomes were examined in relation to the amount of dengue at the week of birth, one week prior to birth, and two weeks prior to birth. After adjusting of confounders, only results for PTB were statistically significant, showing a negative correlation with the rate of dengue for the week of birth (regression coefficient = -0.00552 (<0.0001)), and a positive correlation for the week before birth (regression coefficient = 0.00593 (<0.0001)). The results of these models are surprising, and indicate that at the population level, the amount of dengue is higher the week before preterm birth, but lower in the week that preterm birth occurs. These results are difficult to explain with biologic mechanisms, and do not support the hypothesis that dengue in the population is related to the rate of preterm births. Individual level studies would be required to confirm these findings and to determine what clinical significance dengue infection has on preterm birth in pregnant women infected with dengue.

**Gestational weight gain z-scores and adverse birth outcomes: Comparison with conventional weight gain measures****Bodnar LM\*, Parisi SM, Hutcheon JA, Abrams B  
(University of Pittsburgh, Pittsburgh, PA)**

Conventional measures of gestational weight gain (GWG) are correlated with length of gestation, and induce bias to studies of GWG and pregnancy outcomes. We recently created a weight-gain-for-gestational-age z-score chart that allows us to classify total GWG as a standardized z-score that is independent of gestational duration. We compared associations with adverse birth outcomes when GWG was measured using z-scores, the Institute of Medicine adequacy ratio (observed GWG / expected GWG), and rate of GWG (GWG/gestational age). We used Pennsylvania linked birth-infant death records (2003-2010) of all singleton infants born alive at  $\leq 42$  weeks gestation to normal-weight mothers (prepregnancy BMI 18.5-24.9 kg/m<sup>2</sup>) (n=426,111). GWG z-scores were calculated based on the reference values developed by Hutcheon et al. (2013) in a cohort of Pittsburgh mothers with uncomplicated pregnancies. Very low GWG z-scores were associated with infant mortality and both very low and very high GWG z-scores were associated with preterm birth at  $<37$  and  $<32$  weeks. While the shapes of the risk curves were similar for these outcomes, the GWG adequacy ratio modestly overestimated the risk at the tails of the distribution, while rate of GWG overestimated effects at the low end and slightly underestimated effects at the upper end of the distribution. There was no difference for SGA and LGA across the 3 GWG measures. Conclusions were similar among overweight women (n=222,275). In comparison with z-scores which remove the effect of gestational age, conventional measures (rate or adequacy ratio) provide modestly biased associations with infant mortality and preterm birth.

**Accuracy of reporting of birth defects among stillbirths, Massachusetts Pregnancy to Early Life Longitudinal Stillbirths Project, 2000-2006**

**Gilboa SM\*, Derrington TM, Duke CW, Anderka M, Shapiro-Mendoza CK, Belanoff C, Correa A, Kotelchuck M  
(Centers for Disease Control and Prevention, Atlanta, GA)**

The reporting quality of birth defects on fetal death certificates has been questioned. Using the Massachusetts Pregnancy to Early Life Longitudinal data system, we estimated the sensitivity and positive predictive values (PPV) for the reporting of nine birth defects on the state's fetal death certificate compared with the Massachusetts Birth Defects Monitoring Program (MBDMP): anencephaly; cleft lip with or without cleft palate; cleft palate; diaphragmatic hernia; hypospadias; limb reduction defects; omphalocele/gastroschisis; spina bifida; and trisomy 21. Of the 162 fetal deaths with birth defects captured in the MBDMP between 2000 and 2006, 80 had at least one of the nine birth defects. Both the sensitivity and the PPV were 0% for cleft palate and spina bifida. The sensitivity was 83% for cleft lip with or without cleft palate, 71% for anencephaly, 38% for omphalocele/gastroschisis, 26% for trisomy 21, 0% for limb reduction defects and hypospadias, and could not be estimated for diaphragmatic hernia. The PPV was 56% for anencephaly, 50% for omphalocele/gastroschisis, 33% for cleft lip with or without cleft palate, 28% for trisomy 21, 0% for diaphragmatic hernia, and could not be estimated for hypospadias and limb reduction defects. Low sensitivities for some defects, such as cleft palate or spina bifida, may result from a reluctance to report unconfirmed birth defect diagnoses, especially in the absence of a fetal autopsy; low positive predictive values may result from over-reporting. Stratification by delivery hospital or gestational age may prove helpful, though small sample sizes are a limitation.

**Estimating absolute and relative effects of neighborhood poverty on very preterm birth****Pearl M\*, Balzer L, Ahern J  
(Sequoia Foundation, Richmond, CA)**

While research suggests neighborhood deprivation contributes to preterm birth, less is known about the role of neighborhood deprivation in very preterm birth (VPTB). We aim to estimate the absolute and relative effects of living in an impoverished neighborhood on VPTB. Race-ethnicity specific case control samples were drawn from a linked cohort of 178,296 singleton live births delivered from 2000 to 2007 in southern California who participated in statewide prenatal screening (428/200 White, 436/253 Hispanic and 371/343 Black cases/controls, respectively). VPTB was defined as birth prior to 32 weeks gestation in Whites and Hispanics and prior to 34 weeks in Blacks, based on the best estimate of gestational age recorded for prenatal screening at 15-20 weeks gestation. Neighborhoods of birth residence scoring above the median on an index of census tract income, poverty and public assistance levels were considered high poverty. Marginal estimates of the risk differences (RD) and risk ratios (RR) for each race/ethnicity were obtained using case-control-weighted targeted maximum likelihood estimation, adjusted for age, education, parity, insurance and other neighborhood factors. Among white women (VPTB prevalence=0.63%), the RD and RR associated with neighborhood poverty were 0.49% (95% confidence interval [CI]: 0.32%, 0.66%) and 2.05 (95% CI: 1.61, 2.60), respectively. Effect estimates among Hispanics and Blacks were in the same direction but generally weaker. The results support a potential effect of neighborhood poverty on VPTB, particularly for white women. Future sensitivity analyses will assess possible bias due to unmeasured confounders such as early life socioeconomic conditions.

**Risk assessment for early-onset preeclampsia based on mid-trimester maternal serum angiogenic and anti-angiogenic factors among Whites and Hispanics**

**Yang J, Currier B, Pearl M, DeLorenze GN, Flessel M, Romero R, Chaiworapongsa T, Dong Z, Kharrazi M\***  
(California Department of Public Health, Richmond, CA)

Early-onset preeclampsia is considered an anti-angiogenic state. Increasing maternal serum/plasma levels of placental growth factor (PlGF) (an angiogenic factor) and decreasing levels of soluble vascular endothelial growth factor receptor 1 (sVEGFR-1) and soluble endoglin (sEng) (anti-angiogenic factors) precede syndrome onset. This study developed a risk assessment model for early-onset (<32 weeks gestation) preeclampsia among White and Hispanic prenatal screening program participants. Cases (N=154) and randomly selected controls (N=1607) derived from a cohort of 121,310 singleton live births born in Southern California during 2000-2007. Banked maternal sera collected at 15-20 weeks gestation were tested for concentrations of PlGF, sVEGFR-1, and sEng by enzyme-linked immunosorbent assays. Analyte Multiples of Medians (MoMs), adjusted by gestational age and maternal weight at specimen collection, were calculated separately for Whites and Hispanics. Normalized MoMs were used to calculate odds of early-onset preeclampsia given analyte concentrations. Area under the curve from receiver operating characteristics curves was 0.9 for Whites and Hispanics. Likelihood ratio of a positive test at the optimal cutpoint was 5.3 for Whites and 6.3 for Hispanics. At a detection rate of 75.0%, the false positive rate was 18.0% for Whites and 10.4% for Hispanics. Incorporating maternal serum alpha-fetoprotein, beta-hCG, and unconjugated estriol from prenatal screening into the risk assessment model improved the prediction slightly. The strengths and limitations of risk assessment with PlGF, sVEGFR-1, and sEng for early-onset preeclampsia will be discussed.

**Effect of smoking cessation before and during early pregnancy on fetal and childhood growth: A prospective cohort study**

**Suzuki K\*, Sato M and Yamagata Z  
(University of Yamanashi, Chuo, Japan)**

Maternal smoking during pregnancy is a major cause of intrauterine growth restriction. In addition, recently, an association between maternal smoking during pregnancy and childhood obesity has been suggested. However, few studies have examined these associations, including that of smoking cessation before and during pregnancy and fetal and childhood growth. This study aimed to simultaneously examine these associations using a prospective cohort study in Japan. The study participants comprised 2676 women and their children who were born between 1991-2006. Anthropometric data were compiled through medical check-ups conducted at 3 years of age for 2275 (85.0%) participants. Multiple linear regression models according to sex were used to analyze the data. After adjusting for gestational age, parity, maternal body mass index (BMI), and age; the birth weight of the babies from smoking mothers was found to be significantly lower than that of babies from non-smoking mothers. The birth weight of mothers who quit smoking was not significantly different from that of non-smoking mothers. Next, after adjusting for maternal BMI and BMI of children at birth, the BMI at 3 years of age of the babies from smoking mothers, especially in male children, was found to be significantly greater than that of babies from non-smoking mothers. However, as compared to the BMI of babies from non-smoking mothers, the BMI of babies from mothers who quit smoking was not significantly greater. In conclusion, maternal smoking cessation before and during early pregnancy might be beneficial for fetal and childhood growth.

**Obstetric blood transfusion during pregnancy, birth and the postnatal period****Patterson JA, Ford JB\*, Morris JM, Roberts CL****(Kolling Institute of Medical Research, University of Sydney, New South Wales, Australia)**

Background: Blood is a scarce and costly resource, however is potentially lifesaving in cases of massive obstetric blood loss. Data on obstetric blood transfusions has focussed on use of blood at the time of birth. This study explores trends in blood transfusion during pregnancy, birth and the postnatal period. Methods: Linked birth and hospital data were used to examine rates of maternal blood product transfusion during pregnancy, birth and 6 weeks postpartum, 2001-2009 in hospitals in New South Wales, Australia (N= 797,769 pregnancies). Poisson regression was used to examine risk factors for blood product transfusion in the birth admission with relative risks (RR) and 95% confidence intervals (CI) presented. Results: The blood product transfusion rate was 1.2% of pregnancies, with 9760 mothers receiving a transfusion in 9898 pregnancies or postnatally. The transfusion rate increased steadily from 1.1% in 2001 to 1.5% in 2009. There has been little change in the type of blood products being used, with the majority of women (86%) receiving only packed cells/whole blood. Women with bleeding/platelet disorders were more likely to receive a blood product transfusion than women without these disorders (RR= 7.5, CI 7.0,8.0), as were women having forceps (RR=4.4, CI 4.0,4.9), or vacuum births (RR=2.4 , CI 2.2,2.5) when compared to non-operative births. Seventy-eight percent of transfusions were given in the context of haemorrhage. Conclusions: Rates of obstetric blood product transfusion have increased 34% since 2001. Further exploration of the volume of blood and type of blood product used is warranted.

**Maternal psychosocial stress and risk of adverse birth outcomes in a Hispanic population of predominantly Puerto Rican women****Szegda K\*, Bertone-Johnson E, Pekow P, Powers S, Markenson G, Dole N, Chasan-Taber L  
(University of Massachusetts, Amherst, MA)**

Studies of maternal psychosocial stress and preterm birth (PTB), low birth weight (LBW) and small-for-gestational age (SGA) have been inconsistent, with few conducted among Puerto Rican women, a Hispanic subgroup with high rates of these adverse birth outcomes and subsequent infant mortality. We examined these associations among 1,262 Hispanic pregnant women of Puerto Rican or Dominican descent participating in Proyecto Buena Salud, a prospective cohort study based in Western Massachusetts (2006-2011). Perceived stress was assessed at prenatal visits in early (<19 weeks gestation), mid (19-26 weeks gestation), and late (>26 weeks gestation) pregnancy using Cohen's Perceived Stress Scale (PSS-14). Birth status was abstracted from medical records; 9.3% of births were PTB (<37 weeks gestation), 7.8% LBW (<2500 grams), and 12.4% SGA (<10th percentile birth weight for gestational age). After adjusting for sociodemographic, medical and other psychological factors, women in the highest quartile of mid-pregnancy perceived stress had over 3 times the risk of PTB (Odds Ratio [OR]=3.4, 95% Confidence Interval [CI]=1.3, 9.0, p-trend=0.004) and LBW (OR=3.5, 95% CI=1.3, 9.7, p-trend=0.007) compared to women in the lowest quartile. There was no association between early or late pregnancy perceived stress and PTB or LBW; perceived stress was not associated with SGA. Cumulative duration of exposure to perceived stress and pattern of exposure over the course of pregnancy were not associated with increased risk for PTB, LBW, or SGA. In this predominantly Puerto Rican population of Hispanic women, exposure to elevated levels of mid-pregnancy perceived stress increased risk for PTB and LBW.

**Sleep disorders and race/ethnicity in pregnant and non-pregnant women of childbearing age****Amyx M\*, Xiong X, and Buekens P****(Tulane University School of Public Health and Tropical Medicine, New Orleans, LA)**

The authors sought to examine the association between sleep disorders and race/ethnicity in both pregnant and non-pregnant women of child-bearing age. Self-reported health and sleep characteristics collected by the National Health and Nutrition Examination Survey (NHANES) from 2005 to 2010 were used to conduct this secondary analysis. The present study sample included 3,875 non-pregnant and 507 pregnant women from 15 to 44 years of age. The association between sleep disorders and race/ethnicity was examined using both univariate and multivariate logistic regression, adjusting for age, body mass index, marital status, education, and other confounding variables. In non-pregnant women, the prevalence of trouble sleeping was 22.30% among Mexican-American women, 22.31% among non-Hispanic white women, and 23.05% among non-Hispanic black women; in pregnant women, the prevalences were 17.43%, 29.41%, and 14.55%, respectively. After adjustment for confounders, the significantly decreased risk of trouble sleeping in pregnant Mexican-American and non-Hispanic black women when compared to pregnant non-Hispanic white women persisted, with adjusted odds ratios (aOR) of 0.415 (95% confidence interval 0.173, 0.993) and 0.204 (0.064, 0.647), respectively. Among non-pregnant women, risk did not differ by race/ethnicity (aORs 1.014 [0.758, 1.357] and 1.006 [0.757, 1.337], respectively). We conclude that trouble sleeping is associated with race/ethnicity among pregnant women, but not non-pregnant women, of childbearing age.

**Mothers and fathers consistently report paternal involvement**

**Miller AM\*, Pearce B, Howards PP, Flanders WD, Newport DJ, Hogue CJ**  
(Emory University, Atlanta, GA)

The increased cost and effort associated with including fathers in studies of women's and children's health has made it common to interview women as proxies for the father. Fair to moderate agreement has been observed with paternal demographics, occupation, and alcohol and smoking status. We sought to evaluate agreement between maternal and paternal responses of paternal involvement. Unmarried women and their male partners (n=2,660 couples) from the Fragile Families and Child Wellbeing Study with complete baseline interviews were included. Agreement between maternal and paternal responses to questions on paternal involvement was measured using Cohen's Kappa statistic (K), and a prevalence and bias adjusted kappa (PABAK). For all questions, K was fair to moderate (0.23-0.65), but generally, PABAK was much higher. When asked whether the father provided financial support during pregnancy, agreement was substantial (PABAK=0.77). When asked if the father had indicated that he would provide child support, PABAK was 0.72. When couples were asked if the baby would have the father's last name, PABAK was 0.88. Adjusted agreement was also high when asked if the father's name would be on the birth certificate (PABAK=0.89). PABAKs were highest for cohabiting couples and decreased with decreasing strength of the relationship (visiting, friends, no contact). Unmarried women involved with their child's father are reliable proxy reporters of father involvement. Women reporting little to no contact with the child's father were also fair proxies. Given these findings, use of mothers as paternal proxies is reasonable, with little to no added benefit to interviewing fathers.

**Frequency of the congenital transmission of Trypanosoma cruzi infection: A systematic review and meta-analysis****Howard EJ\*, Xiong X, Carlier Y, Sosa-Estani S, Buekens P  
(Tulane SPHTM, New Orleans, LA)**

Chagas disease is a parasitic disease caused by *Trypanosoma cruzi* (*T. cruzi*) that is endemic in much of Latin America, but a risk in any country due to the congenital mode of transmission and immigration. The objective of this analysis was to assess the frequency of congenital transmission of *T. cruzi*. Six databases were searched using seven search terms related to Chagas disease or *Trypanosoma cruzi* and congenital transmission. The inclusion criteria were the following: Dutch, English, French, Portuguese or Spanish language; case report, case series or observational study; original data on congenital *T. cruzi* infection in humans; congenital infection rate reported or the measure could be derived from data. This systematic review included 13 case reports and 56 observational studies; 55 were included in the meta-analysis. Two investigators independently collected data on study characteristics, method of diagnosis and the congenital infection rate. The principal summary measure was the congenital transmission rate, defined as the number of congenitally infected infants divided by the number of infants born to infected mothers. The pooled congenital transmission rates were calculated a random effects model. Reported congenital transmission rates ranged from 0% to 45.5% with a pooled congenital *T. cruzi* transmission rate of 0.0488 (95% CI: 0.040-0.057). Subgroup and sensitivity analyses provided similar results. Congenital transmission of Chagas disease is a global problem. Overall risk of congenital infection in infants born to infected mothers is about 5%. The congenital mode of transmission requires targeted screening in order to prevent future cases of Chagas disease.

**Association of complementary and alternative medicine therapies and mental health outcomes in a pregnant, low-income population**

**Barcelona de Mendoza V\*<sup>1</sup>, Harville EW<sup>1</sup>, Giarratano G<sup>2</sup>, Savage J<sup>3</sup>**  
(<sup>1</sup>Tulane University School of Public Health and Tropical Medicine, New Orleans, LA;  
<sup>2</sup>LSU Health Sciences Center School of Nursing; <sup>3</sup>Loyola University School of Nursing)

In post-disaster environments such as New Orleans, many women lack access to mental health treatment and mental illnesses persist. Complementary and alternative medicine (CAM) therapies are commonly used by low-income, pregnant women to cope, yet their association with mental health outcomes is not known. 299 pregnant women were recruited from prenatal and community clinics. Questionnaires were administered to assess use of CAM, depression, post-traumatic stress disorder (PTSD), perceived stress and pregnancy-related anxiety (PA). The most commonly reported therapies were prayer (86.9%), music (73.1%), multivitamins (44.4%), massage (36.4%), and aromatherapy (29.2%). One quarter of the sample had likely depression, half were at risk for depression, 10% had likely PTSD, and 20% had symptoms of PA. In women with likely diagnosis of depression, massage was protective (aOR 0.74, 95% CI 0.56-0.97), while use of aromatherapy (aOR 1.33, 95% CI 1.05- 1.7) and meditation (aOR 1.36, 95% CI 1.05-1.75) were associated with increased risk. Massage was also beneficial for women in terms of reported stress symptoms (aOR 0.53, 95% CI 0.29-0.98). Aromatherapy appeared to be associated with poor mental health outcomes, as the 27.6% of women who reported using it had symptoms of pregnancy-related anxiety (aOR 1.87, 95% CI 1.18-2.96). Similarly, women who prayed were more likely to have PA than those who did not (aOR 5.09, 95% CI 1.29-20.01). CAM therapies were widely used in this sample and were associated with a variety of mental health outcomes. Further research is necessary to explore clinical implications for this vulnerable population.

**Does improved survival of preterm deliveries explain the sharp rise in preterm live births in Puerto Rico from 1995 - 2006?****Gibbs CM\*, Hogue CJR****(Department of Epidemiology, Rollins School of Public Health, Emory University)**

Preterm births (<37 weeks' gestation) recently rose steeply in Puerto Rico, from 12.3% in 1995 to 19.9% in 2006. Previous analyses examining only live births failed to explain this trend. We examined trends in preterm delivery (PTD, live births and fetal deaths from 20-36 weeks' gestation) from 1995-2006 using U.S. Vital Statistics Records (fetal death and birth cohort linked birth-infant death datasets). We hypothesized that the percent of PTDs would be stable from 1995-2006 but that preterm stillbirths, as a proportion of total PTDs, would decrease. Furthermore, we hypothesized that the increase in preterm birth (PTB) would be explained by rising numbers of moderately PTBs (MPTBs, 32-36 completed weeks' gestation). We reasoned that improved obstetric management at moderately preterm gestations would lead to more obstetric interventions and result in fewer stillbirths but more frequent live PTBs. We report 2-sided p-values for Cochran-Armitage trend tests for PTD, PTB, MPTB, and neonatal death. Results: PTDs rose significantly from N = 8,297 in 1995 to 10,129 in 2006 (Z= 58.3, p <0.0001). Percent of PTDs that were stillbirths decreased from 6.1% to 4.3% (Z= -10.61, p<0.0001). The significant rise in PTBs (Z= 59.1, p<0.0001) was explained by the rise in MPTBs (Z= 11.5, p <.0001). The percentage of PTBs ending in neonatal death decreased from 5% to 2.6% (Z= -14.7, p<0.0001). Conclusion: The recent increase in PTBs in Puerto Rico is limited to MPTBs and may be due in part to increased obstetric intervention that has led to improved fetal and neonatal survival.

**Maternal body burden of cadmium and risk of gestational diabetes**

**Romano ME\*, Enquobahrie DA, Checkoway H, Simpson C, Williams MA  
(University of Washington, Department of Epidemiology, Seattle, WA)**

Background: Environmental cadmium exposure has been associated with impaired fasting glucose and type 2 diabetes. Likewise, animal models have suggested a diabetogenic effect of cadmium. An association with gestational diabetes mellitus (GDM) has not been explored. We investigated whether greater maternal body burden of cadmium increases GDM risk. Methods: We conducted a case-cohort study among 195 GDM cases and 750 subcohort members, randomly drawn from a large prospective cohort created to examine risk factors for pregnancy complications. Women enrolled early in pregnancy (16 gestational weeks on average) and provided clean-catch spot urine samples. Urinary cadmium was measured using inductively coupled plasma mass spectrometry and creatinine-corrected. Between 24 and 28 weeks gestation all women were screened for GDM according to American Diabetes Association guidelines. Adjusted odds ratios (ORs) and corresponding 95% confidence intervals (CIs) were estimated using multivariable logistic regression models adjusted for age, pre-pregnancy body mass index, family history of diabetes, and family history of hypertension. Results: The geometric mean of urinary cadmium was 0.41  $\mu\text{g/g}$  creatinine, which falls between the 50th and 75th percentile of exposure among the general population in the United States. We observed an increasing gradient of GDM risk associated with urinary cadmium level. The OR (95% CI) trend according to increasing urinary cadmium tertiles ( $<0.29$ ;  $0.29-0.42$ ;  $\geq 0.43$   $\mu\text{g/g}$  creatinine) was: 1.0 (referent); 1.6 (0.9-2.8); 1.9 (1.1-3.2); p-trend =0.02. Conclusion: Our results suggest that greater body burden of cadmium increases women's risk of GDM. Future studies are warranted to replicate our findings in other populations.

**Physical activity and sedentary behaviors in relation to the risk of progression from gestational diabetes to type 2 diabetes: Findings from the Diabetes & Women's Health Study**

**Bao W\***  
(NICHD, NIH, Bethesda, MD)

Physical inactivity and prolonged television (TV) watching have been associated with an elevated risk of type 2 diabetes (T2DM) in the general population. Women who develop gestational diabetes (GDM) are at substantially increased risk for T2DM later in life. Little is known about the roles of physical activity and sedentary behaviors in determining the progression from GDM to T2DM. As part of the Diabetes & Women's Health Study participants, 4,514 women in the Nurses' Health Study II who had a history of GDM were followed up from 1991 to 2007. The duration and intensity of physical activity were assessed by a detailed questionnaire in 1991, 1997, 2001 and 2005. Relative risks (RRs) and 95% confidence intervals were estimated using Cox proportional hazards models. We documented 635 incident T2DM cases during 64,258.3 person-years of observation. After adjustment for age, parity, non-dietary and dietary factors, the RRs across increasing quintiles of total physical activity were 1.00, 0.86, 0.75, 0.64, and 0.66 (P for trend = 0.004). Among sedentary behaviors, the multivariate RRs for T2DM among women with sedentary time for TV watching of 0-4.9, 5.0-9.9, 10.0-19.9, and  $\geq$  20.0 hours/week were 1.00, 1.05, 1.64, and 1.47, respectively (P for trend = 0.001). These associations were attenuated substantially and became statistically non-significant after additional adjustment for body mass index (BMI). In conclusion, among women with prior GDM, physical activity is inversely associated with T2DM risk, while TV watching is positively associated with the risk. These associations may be largely mediated by BMI.

**Prepregnancy low-carbohydrate diet scores and the risk of gestational diabetes mellitus: A prospective cohort study****Bao W\*, Bowers K, Tobias D, Hu F, Olsen S, Chavarro J, Vaag A, Zhang C  
(NICHD, NIH, Bethesda, MD)**

Low-carbohydrate diets (LCDs) have been vastly popularized, despite concerns of their long-term efficacy and safety. Previous studies have examined the individual association of carbohydrate, protein and fat intake with the risk of gestational diabetes mellitus (GDM). However, their combined effect as measured by LCD score on GDM risk remains unknown. Our study included 21,457 singleton pregnancies without chronic diseases before pregnancy or previous GDM in the Nurses' Health Study II between 1991 and 2001. Overall, animal and vegetable LCD scores were calculated from food-frequency questionnaires, with a higher score reflecting a higher intake of protein and fat and a lower intake of carbohydrate. Generalized estimating equations with log-binomial models were used to estimate the relative risks (RRs) and 95% confidence intervals (CIs). We documented 870 incident GDM pregnancies during the 10 years of follow-up. After adjustment for age, parity, non-dietary and dietary factors, and body mass index, prepregnancy overall and animal LCD scores were significantly and positively associated with GDM risk while vegetable LCD score was not significantly associated with the risk. The RRs (95% CIs) comparing the highest with lowest quintiles were 1.59 (1.29-1.96) for overall LCD score, 1.41 (1.15-1.72) for animal LCD score, and 0.82 (0.66-1.02) for vegetable LCD score. These associations were not significantly modified by age, parity, family history of diabetes, or physical activity. In conclusion, a prepregnancy diet with lower carbohydrate and higher protein and fat, in particular protein and fat from animal food sources, is significantly and positively associated with GDM risk.

**Early pregnancy maternal vitamin D concentrations and risk of gestational diabetes mellitus****Arnold DL\*, Enquobahrie DA, Grote N, Vander Stoep A, Williams MA  
(University of Washington, Seattle, WA)**

Background: Previous studies examining associations of maternal vitamin D with gestational diabetes mellitus (GDM) risk reported inconsistent findings. Whether pre- or mid-pregnancy body mass index (pp-BMI or mp-BMI) modify these associations is unknown. Methods: In a case-cohort study (N=135 cases and N=517 randomly selected sub-cohort), nested within a prospective cohort study, we examined associations of vitamin D with GDM. Liquid chromatography-tandem mass spectroscopy was used to measure maternal serum vitamin D (total 25[OH]D and 25[OH]D3) in early pregnancy (16 weeks on average). GDM was diagnosed according to American Diabetes Association guidelines. Logistic regression models were used to calculate adjusted odds ratios (ORs) and 95% confidence intervals (CI). Results: GDM cases had lower mean total 25[OH]D (27.3 vs. 29.3ng/ml) and 25[OH]D3 (23.9 vs. 26.7ng/ml) concentrations compared with women who did not develop GDM (both p-values<0.05). In regression models, 25[OH]D3, but not total 25[OH]D, was significantly associated with GDM risk. A 5ng/ml increase in 25[OH]D3 was associated with a 14% decrease in GDM risk (p-value=0.02). Women in the three upper quartiles for 25[OH]D3 had a 41-54% lower risk of GDM compared with women in the lowest quartile for 25[OH]D3 (p-value for trend<0.05). Adjustment for pp-BMI or mp-BMI did not change risk estimates significantly. Further, we did not observe significant interaction between pp-BMI and vitamin D on GDM risk (interaction p-value>0.05). Conclusion: Early pregnancy vitamin D, particularly 25[OH]D3, is inversely associated with GDM risk. Larger studies are warranted to evaluate interactions of vitamin D with pp-BMI or mp-BMI on GDM risk.

**Inorganic arsenic exposure and gestational diabetes: A case-control study****Peck JD\*, Stoner JA, Davis EM, Goodman JR and Caldwell K  
(University of Oklahoma Health Sciences Center, Oklahoma City, OK)**

Pregnancy is characterized by progressive insulin resistance; thus, pregnant women may be susceptible to effects of environmental exposures such as arsenic that alter glucose homeostasis. We conducted a case-control study to investigate the association between urinary biomarkers of inorganic arsenic exposure during pregnancy and gestational diabetes (GDM). Pregnant women undergoing 1-hour 50 g glucose challenge tests between 2009-2010 were recruited from OU Medical Center (median gestational age: 29 wks, range 10-40). Cases (n=64) were women with screening glucose values  $\geq 135$  mg/dl and subsequent 3-hour 100 g oral glucose tolerance test with at least 2 values above diagnostic thresholds, or screening values  $\geq 200$  mg/dl. Controls (n=237) were selected consecutively from those completing screening without a GDM diagnosis. Urinary concentrations of total arsenic, 4 inorganic (arsenic acid, arsenous acid) or inorganic metabolite species (dimethylarsinic acid, monomethylarsonic acid), and 3 relatively non-toxic organic species (arsenobetaine, arsenocholine, trimethylarsine oxide) were measured by inductively coupled plasma-dynamic reaction cell-mass spectrometry. Methods to estimate inorganic arsenic exposure included: 1) summing concentrations of the 4 inorganic and inorganic metabolite species; 2) subtracting arsenobetaine concentrations (a measure of organic arsenic from dietary sources) from total arsenic; and 3) evaluating total arsenic concentrations among those without detectable arsenobetaine concentrations (i.e., non-seafood eaters). Using logistic regression analyses, we did not observe statistically significant associations between inorganic arsenic exposure tertiles and case status. Odds ratios were typically  $< 1.25$ , adjusting for creatinine, age, race/ethnicity, obesity, smoking and education. These findings do not support the hypothesized association between inorganic arsenic exposure and GDM.

**The association between late preterm and early term birth and neonatal intensive care unit triage/admission: Role of the biological determinants of early delivery****Brown HK\*, Speechley KN, Macnab JJ, Natale R, Campbell MK  
(Department of Epidemiology and Biostatistics, The University of Western Ontario,  
London, Ontario)**

It is unclear to what extent poor outcomes among infants born late preterm (34-36 weeks) and early term (37-38 weeks) are associated with physiological immaturity or with conditions that led to early delivery. The objective of this analysis was to determine whether the biological determinants of preterm birth, such as infection and placental ischemia, modify the effect of gestational age on the risk of neonatal intensive care unit (NICU) triage/admission. The sample included singleton live births, delivered at 34-41 weeks with no major congenital anomalies (N=38,807). Data from the London Health Sciences Centre (London, Canada) perinatal database were linked with discharge abstracts data. Multivariable models were built using modified Poisson regression. Additive interactions between gestational age (late preterm, early term, vs. full term) and the biological determinants of preterm birth were assessed by calculating the relative excess risk due to interaction (RERI), where  $RERI > 0$  indicates positive interaction (excess risk). There was evidence of excess risk due to interaction for placental ischemia and late preterm (aRERI=2.35, 95% CI 1.22, 3.55) and early term birth (aRERI=0.85, 95% CI 0.49, 1.22). Similarly, there was excess risk due to interaction for other determinants (diabetes, premature rupture of the membranes) and late preterm (aRERI=1.73, 95% CI 0.49, 3.12) and early term birth (aRERI=0.75, 95% CI 0.28, 1.24). There was no excess risk due to interaction for infection and gestational age. Among near term deliveries, there are high risk groups, defined by conditions leading to early delivery, which are at even greater risk for poor outcomes.

**Population-level predictors of racial-ethnic variation in US preterm birth****Carmichael SL\*, Cullen MR, Mayo JA, Dagli P, Gould JB, Stevenson DK, Wise PH, Shaw GM****(March of Dimes Prematurity Research Center, Stanford University, Stanford, CA)**

Preterm birth (PTB) prevalence varies from 9-18% across U.S. states and is twice as high for babies born to black women as white women. We examined predictors of county-level variation in prevalence of very PTB (vPTB, delivery at 20-31 weeks) and moderately PTB (mPTB, 32-36 weeks) among US births to black and white women from 1998-2002. Predictors (race-ethnicity-specific where applicable) were percent of women who had low or high education or high occupation; were married, immigrants or living in poverty; mean household income, property values, black-white income disparity, Gini coefficient; percent homeowners; population growth rate; Southern or urban counties; proportion of county that was black; air pollution (mean PM2.5 concentration); and fast food availability (based on restaurant sales). Counties with populations <100,000 were collapsed with adjacent counties to reach that threshold (referred to as counties for simplicity). Counties with  $\geq 20$  PTBs were included (468 for black women, 945 for whites). Based on population weighted ordinary least squares regression, predictors explained 38% of variability in vPTB prevalence and 47% of mPTB among black women, versus 63% and 64% among white women, respectively. Higher Gini coefficient, fewer immigrants, urban counties, warmer summer climate, slower population growth and air pollution were associated with increased PTB prevalence in most models. Higher percent with high occupation, higher property values, and non-Southern counties were associated with lower PTB among whites but not blacks. These predictors explain substantial variation in PTB prevalence but were somewhat different for black and white women and for vPTB and mPTB.

**Early pregnancy maternal dietary fish intake and pregnancy complications: The Omega Study****Wicks AF<sup>\*,1</sup>, Thompson ML<sup>1</sup>, Burbacher TM<sup>1</sup>, Siscovick DS<sup>1</sup>, Williams MA<sup>2</sup>, Enquobahrie DA<sup>1</sup>****(<sup>1</sup>University of Washington Seattle, Seattle, WA; <sup>2</sup>Harvard School of Public Health, Boston, MA)**

Background: The relationship between dietary fish (and subtypes) and pregnancy complications has not been fully described. We investigated associations of early pregnancy dietary fish intake with pregnancy complications. Methods: Among participants (N=3355) of the Omega cohort, a prospective study of dietary risk factors for pregnancy complications, in Seattle, Washington (1996-2008), a food frequency questionnaire was used to assess early pregnancy dietary fish and subtypes (fried, shell, white, and dark fish). Information on pregnancy complications, including preeclampsia (PE), gestational hypertension (PIH), gestational diabetes (GDM), and preterm birth (PTB) was obtained from medical records. We used generalized linear models with a log-link, the Poisson family and robust standard errors, to estimate relative risks (RRs) and 95% confidence intervals (CI). Results: Amount or frequency of total fish consumption was not associated with pregnancy complications. Higher intake of fried fish was associated with a higher, though statistically insignificant, risk of pregnancy complications (PE and PIH). Higher shellfish intake was associated with lower risk of PTB. Women who reported intake  $\geq 3$  servings/week had a 39% lower risk of PTB compared with women who reported intake  $< 1$  servings/week (95%CI:0.39-0.98). White fish consumption was associated with higher risk of GDM (RR:2.81; 95%CI:1.18-6.70 comparing highest to lowest intake), but not the other pregnancy complications. Consumption of dark fish was negatively associated with risk of GDM. The adjusted RRs comparing  $> 3$  servings/week to  $< 1$  serving/month of dark fish was 0.38 (95%CI:0.19-0.78) for GDM. Conclusion: The risk of pregnancy complications varies by the type of fish consumed in early pregnancy.

**Screening for precocious cervical ripening to predict preterm delivery****Li Q\*, Holzman C, Paneth NS, Keith L****(Department of Epidemiology & Biostatistics, Michigan State University; Department of Obstetrics and Gynecology, Northwestern University)**

Precocious cervical ripening is a dynamic, latent stage preceding spontaneous preterm deliveries (PTD) and a potential target for screening, either to initiate an intervention or to plan for high-risk delivery. Indicators of precocious cervical ripening include cervical length and cervical funneling, but it is common practice to primarily consider cervical length. This review evaluates the predictive performance of comprehensive screening tools for precocious cervical ripening that assess multiple cervical indicators. We searched PubMed, EMBASE, and Chinese electronic databases for large ( $n > 500$ ) observational cohort studies of general obstetric populations. Ten datasets ( $n = 22,050$  pregnancies) described within 12 peer-reviewed articles assessed multiple dimensions of precocious cervical ripening. Most studies were from high-income countries, some of which integrated cervical assessment in routine prenatal care. Studies varied by outcome, i.e. early PTD or all PTD, and by cervical assessment, i.e. mode, timing, and frequency. Across seven studies with transvaginal ultrasonography (TVU) data, ranges of sensitivity, specificity, and positive predictive value were 7%-49%, 87%-97%, and 6%-18% for cervical length and 8%-33%, 92%-99%, and 3%-38% for cervical funneling. In three studies, specificity was higher for cervical funneling than for cervical length. Five studies reported improved performance by using both cervical length and funneling from TVU to create composite measures. Methodological quality varied across studies and only one study reported on inter-rater reliability. Comprehensive cervical screening to predict PTD has captured the interest of obstetric practitioners. Our review highlights the need to develop optimal, evidence-based protocols, i.e. indicators, timing and frequency, to screen for precocious cervical ripening.

**The sensitivity of length of pregnancy using clinical estimate of gestation versus last menstrual period: An example with particulate matter and preterm birth****Rappazzo KM\*, Lobdell DT, Messer LC, Poole C, Daniels JL  
(University of North Carolina, Chapel Hill, NC)**

Estimating gestational age is usually based on last menstrual period date (LMP) or clinical estimation (CGA); both approaches introduce error and potential bias. Differences in the two methods of gestational age assignment may lead to misclassification and differences in risk estimates, particularly if exposure assignment is also dependant on gestation. To examine how these gestational age estimation approaches produced different cohort compositions, we constructed two 20-week gestational age cohorts of pregnancies between 2000 and 2005 from live birth certificates: one defined preterm birth (PTB) status using CGA and the other using LMP. Within these two populations, we estimated risk of birth in 4 preterm categories (PTBs per 106 pregnancies) and risk differences (RD (95% confidence intervals)) for exposure to particulate matter under 2.5 micrometers in aerodynamic diameter (PM<sub>2.5</sub>). Though the overall cohort was 10% smaller (1,730,969 versus 1,940,212), substantially more births were classified as preterm using LMP compared with CGA estimation (278,031(16%) versus 156,325(8%)). Divergences in RDs between the two cohorts increased as exposure weeks approached delivery. For example, among births between 28-31 weeks, RDs for PM<sub>2.5</sub> exposure at week 7 were 44(13, 76) and 46(23, 69) for clinical and LMP populations, respectively; while RDs with exposure at week 26 were 11(-10, 33) and -19(-49, 11). Results are sensitive to the choice of gestational age estimation, though the degree of sensitivity varies across exposure weeks. Estimation choice is critical, particularly when both outcome and exposure are dependent on the result. This abstract does not reflect EPA policy.

**Paternal involvement and birth outcome**

**Nanda V\*, David R, Rankin K, Collins J**  
(John H. Stroger Hospital, Chicago)

Introduction: Low birth weight (LBW) rates for black infants are double the rates for whites. Black and white mothers differ on many social and medical risk factors, none more dramatically than father involvement. The degree to which this constitutes an independent risk factor is incompletely understood. Methods: The birth records of 55,457 white and 45,916 black infants born in Illinois 1989-91 were linked to the birth records of their mothers (born 1956-76.) Neighborhood income was appended from census data. Father involvement classification: married, not married but father named, or not-named. The crude and adjusted odds ratios of infant LBW associated with unmarried or not-named status (compared to married) were determined for white and black births. Results: For whites, 8.6% were unmarried and 6.2% not-named; LBW rate was 4.4%. For blacks 23.9% were unmarried and 57.6% not-named; LBW rate was 13.0%. The OR (CI) of LBW for whites was 2.00 (1.78-2.26) for unmarried and 2.57 (2.27-2.91) for not-named. For blacks: 1.35 (1.23-1.48) for unmarried and 1.76 (1.62-1.91) for not-named. Focusing on the highest risk (not-named) category, adjustment for SES (maternal education and income) reduced the OR by about 30% (2.10 [1.83-2.42] whites, 1.55 [1.40-1.71] blacks). Adjustment for biomedical factors (maternal LBW, age, parity, inter-birth interval, smoking, prenatal care, diabetes) had about the same effect for whites (OR 2.11 [1.78-2.49]) but no attenuation for blacks (OR 1.83 [1.66-2.03]). The population attributable risk for father involvement was 14% for whites and 28% for blacks. Policies that support paternal involvement could reduce racial disparities in birth outcomes.

**Maternal circulating microRNAs and risk of preterm birth****Enquobahrie D\* Tadesse M, Holzman C, Williams MA  
(University of Washington, Seattle, WA)**

Background: While accumulating evidence supports the role of epigenetic mechanisms in preterm birth (PTB), few investigators have examined microRNA (miRNA) expression and PTB risk. Potential race-specific differences in miRNA-PTB associations are unknown. Methods: In a multi-phased case-control study, we investigated associations of circulating miRNA expression with PTB risk among participants of two multi-racial pregnancy cohorts, the Omega Study and the Pregnancy Outcomes and Community Health (POUCH) study. Peripheral blood was collected from participants (16-22 weeks gestation, on average); and, plasma miRNA expression was characterized using candidate (20 miRNAs among 40 PTB cases and 40 controls) and global (319 miRNAs among 355 PTB cases and 355 controls) profiling approaches. Cohort and race specific analyses were conducted using logistic regression. Results: In global profiling, expression of miR-374a and miR-33a was up-regulated (Omega study, p-values=0.02) while expression of miR-4281 was down-regulated (POUCH study, p-value=0.01) among PTB cases. In candidate profiling, expression of miR-361-5p was up-regulated (p-value=0.02) while expression of miR-483-5p (p-value=0.01) and miR-342-3p (p-value=0.019) was down-regulated, all in the POUCH study. In race-stratified analyses, expression of miR-664 (p-value=0.02), miR-1301 (p-value=0.02), and miR-483-5p (p-value=0.02) was associated with PTB risk among Whites while expression of miR-125a-5p (p-value=0.03) was associated with PTB risk among Blacks (all down-regulated). MiRNAs -374a, -33a, and 342-3p participate in RAS and Ca/Calmodulin-dependent kinase signaling, while miR-125a-5p participates in inflammation/apoptosis regulation. Conclusion: Epigenetic regulation of smooth muscle contraction, in the general population, and inflammation, among Blacks, contribute to PTB risk. Mid-pregnancy circulating miRNAs can help identify women at high risk for PTB.

**Partner support during pregnancy and risk of preterm birth****Miller AM\*, Pearce B, Howards PP, Newport DJ, Hogue CJ  
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Little is known about the role of partner support during pregnancy and the prevention of adverse pregnancy outcomes, especially among women with psychiatric illness. These women are at increased risk of outcomes such as preterm birth. Pregnant women (n=189) with histories of psychiatric illness completed the Dyadic Adjustment Scale (DAS) to measure partner relationship quality and the modified Postpartum Social Support Questionnaire (PSSQ) to measure anticipated postpartum social support from multiple sources (partner, parents, in-laws, friends). We evaluated the association of relationship quality and partner support with preterm birth, defined as a live birth before 37 completed weeks of gestation. DAS and PSSQ scores were dichotomized at the median. Low relationship quality was associated with a decreased risk of preterm birth (OR = 0.38; 95% CI: 0.15, 0.93). Low support from the partner was not associated with preterm birth (OR=0.66; 96% CI: 0.28, 1.52), nor was low social support from all sources (OR=1.15; 95% CI: 0.50, 2.64). Adjustment for maternal age and previous preterm birth did not modify observed associations. For pregnant women with psychiatric illness, low levels of partner support may be associated with a decreased risk of preterm birth. This finding, though imprecise, and contrary to what would be expected, may indicate a more complicated relationship between women, their support system, and their partners during pregnancy. These findings may not extend to the general population, and this study should be replicated in healthy pregnant women.

**Maternal pre-pregnancy folate intake and risk of spontaneous abortion**

**Gaskins AJ \*, Hauser R, Williams PL, Gillman MW, Missmer SA, Rich-Edwards J, Chavarro JE**  
**(Harvard School of Public Health, Boston, MA)**

Background: In experimental studies, folic acid supplementation promotes fetal survival. However, the association of folate intake with fetal loss in humans is unclear. We assessed pre-pregnancy folate and multivitamin intake and risk of spontaneous abortion (SAB). Methods: We prospectively examined the relations of dietary folate intake and multivitamin supplementation with risk of SAB among 14,390 women in the Nurses' Health Study II from 1992-2009. We assessed folate intake and multivitamin use every 4 years by food-frequency questionnaire (FFQ) starting in 1991. Pregnancies were self-reported, with case pregnancies lost spontaneously at <20 weeks gestation and comparison pregnancies ending in ectopic pregnancy, induced abortion, or live birth. We fit multivariable log-binomial regressions using generalized estimating equations. Results: Among the women (mean age=32years, 90% Caucasian, 28% past/current smokers), 24,813 pregnancies were reported and 5,092 (20.5%) ended in SAB. After adjusting for energy intake, age, BMI, physical activity, year of pregnancy, pregnancy at FFQ assessment, and use of infertility drugs, women in the highest (>587 mcg/day) vs. lowest (none) quintile of supplemental folate had a relative risk (RR) for SA of 0.80 (95% confidence interval (CI) 0.74, 0.86). Women in the highest (>408) vs. lowest (<246) quintile of food folate had a multivariable RR for SA of 1.08 (95%CI 1.00, 1.17). Women who consumed  $\geq 6$  vs. 0 multivitamin tablets/week had a multivariable RR for SA of 0.85 (95%CI 0.80, 0.90). These relations were consistent across gestational periods. Conclusions: Higher intake of folic acid from supplements and multivitamins was associated with reduced risk of SAB.

**Parental attitudes towards sex and birth outcomes among adolescents**

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Context: Giving birth during adolescence is associated with a number of pregnancy complications. Parents' attitudes towards pregnancy, sex, and birth control may influence the health of the pregnant adolescent. The goal of this project is to examine how adolescent and parental attitudes towards sex and birth control are related to pregnancy outcomes among adolescent mothers. Methods: 773 female participants in Waves I and IV of the National Longitudinal Study of Adolescent Health (Add Health), a nationally-representative sample of students enrolled in grades 7-12 in 1994-95 and followed up in 2007-2008. Parental report of relationship satisfaction, disapproval of adolescent having sex, and sexual communication attitudes; and adolescent report of permissiveness were examined as predictors of self-reported birth outcomes (birthweight and gestational age as continuous variables). Weighted multivariable linear regression models were run incorporating interactions by race (Black/non-Black). Results: For Black adolescents, parental approval of having sex was associated with lower birthweight, as was lower-than-median comfort in discussing sex. For non-Black adolescents, a moderate amount of discussion of birth control was associated with higher birthweight. Among Black adolescents, a better relationship with parents was associated with higher gestational age, while among non-Black adolescents, higher permissiveness was associated with higher gestational age. Conclusions: Among parents of adolescents who get pregnant, moderate amounts of comfort with and approval of sex are associated with the best outcomes.

**Association between exposure to lead in soils and preterm birth in Medicaid women in South Carolina****Liu J\*<sup>1</sup>, Aelion M<sup>2</sup>, McDermott S<sup>1</sup>****(<sup>1</sup>University of South Carolina, Columbia, SC; <sup>2</sup>University of Massachusetts Amherst)**

Preterm birth, defined as birth at <37 weeks of gestation, is a significant public health problem in both the United States (US) and South Carolina (SC). While environmental exposure to lead (Pb) has been implicated in preterm birth, no studies have examined this association in a Medicaid population in the US. Soil samples were taken from 11 areas in SC, analyzed for total Pb (in mg/kg), and Pb concentrations were spatially interpolated at the geocoded addresses of mothers enrolled in SC Medicaid, and giving birth from 1996-2001 (n=8,664). Demographics and risk factors were obtained from SC birth certificates, Medicaid billing records and US Census 2000 data. We found that in the crude model, the odds of having a preterm birth was 1.20 times higher among mothers living in areas at or above the median Pb concentration ( $\geq 38.3$  mg/kg) as compared to those with Pb below the median; odds ratio (OR) = 1.20 and 95% confidence interval (CI): 1.05, 1.38. After adjusting for individual level risk factors, the odds of having a preterm birth was still higher for mothers with Pb concentrations above the median (OR = 1.17, 95% CI: 1.01, 1.35). This association did not remain significant ( $p > 0.05$ ) after adjusting for neighborhood level risk factors. Both maternal race, and predominately black neighborhoods, were associated with preterm birth, suggesting a preterm birth racial disparity in this population. These results indicate environmental exposure to Pb in soils may be a risk factor for preterm birth that should be considered for this population.

**Maternal serum perfluoroalkyl substances and maternal and neonatal thyroid function****Wang Y \*, Rogan WJ, Chen P, Lien G, Chen H, Longnecker MP, Wang S  
(National Institute of Environmental Health Sciences, Durham, NC)**

Perfluoroalkyl Substances (PFASs) are organic compounds with hydrogen replacing fluorine on the carbon chain. They have been widely used in industry and are often detectable in humans. PFASs interfere with thyroid homeostasis in pregnant rats and their pups. In humans, maternal thyroid hormone supplies the fetus throughout pregnancy, and thyroid hormones play a critical role in fetal growth and neurodevelopment. Thus the present study was designed to investigate the associations between maternal PFAS exposure and thyroid function in pregnant women and neonates. In a study of health and environmental exposures in Taiwan, 241 pregnant women had serum concentrations of nine PFASs, thyroxin (T4), free T4, and thyroid stimulating hormone (TSH) measured in the third trimester and in cord serum. Associations between PFASs and thyroid function test results were examined in linear regression models with adjustment for potential confounders. Concentrations of maternal perfluorononanoic acid (PFNA), perfluoroundecanoic acid (PFUnDA) and perfluorododecanoic acid (PFDoDA) were inversely associated with free T4 levels in pregnant women; for example, there was a 0.8% decrease (95% CI: -1.2%, -0.4%) in maternal free T4 per ng/mL increase in maternal PFUnDA. Pregnant women with higher concentrations of perfluorooctanoic acid (PFOA) and perfluorohexanesulfonic acid (PFHxS) also had higher TSH levels. Finally, maternal PFDoDA was inversely related to neonatal total T4 levels in cord serum. In conclusion, maternal serum concentrations of PFASs were associated with thyroid function test results in both pregnant women and neonates. However, the associations were subtle and of unclear clinical significance.

**Systems factors in obstetric care: The role of daily obstetric volume****Snowden JM\*, Darney BG, Cheng YW, McConnell KJ, Caughey AB  
(Oregon Health and Science University, Portland, OR)**

Hospital-level systems factors (e.g., annual delivery volume, provider staffing) affect obstetric and perinatal outcomes, but the mechanisms underlying these associations are not well understood. Daily fluctuation in deliveries (i.e., relative daily volume) is one systems factor that has not been analyzed. We sought to determine whether relatively high-volume days are associated with higher rates of birth asphyxia in California hospitals. We analyzed linked data from birth certificates and hospital discharge records for California births in 2006. The sample included non-anomalous, live-born, singleton births (N=462,322) from California maternity hospital with 50 or more deliveries in 2006 (n=257 hospitals). Birth asphyxia was analyzed as a marker of quality of obstetric care. Asphyxia rates were compared between hospital-specific relatively high-volume days (days where the number of births exceeded the 75th percentile of daily volume for that hospital) and low-volume days, stratified by weekend/weekday and overall hospital obstetric volume. Logistic regression was used to analyze associations between birth asphyxia and relative daily volume controlling for confounding. On weekends, relatively high-volume days were significantly associated with an elevated risk of asphyxia (27/10,000 versus 17/10,000; P=0.014), while no association was present on weekdays. The elevated risk for relatively high-volume weekend days was confined to lower- and medium-volume hospitals. These associations were confirmed by the multivariable regression models with interaction terms. Delivery on relatively high-volume weekend days, when systems may not be able to accommodate fluctuations in patient load, is a risk factor for birth asphyxia in California.

**Factors associated with low and very high use of prenatal care in France****Rio I, Prunet C, Blondel B\*****(INSERM Unit U953 Epidemiological Research in Perinatal Health and Women's and Children's Health, Paris, France)**

Introduction: Recommendations for prenatal care include a minimum standard of care, but also advise to avoid excessive use of services for low risk pregnancies. The factors associated with inadequate prenatal care are well known, but those relating to very high levels of use have been less studied. This study aimed to analyze determinants of low and very high use of prenatal care. Methods: A representative sample of births from the French Perinatal Survey (n = 14,546) was classified following French recommendations for care as: 1) low: late onset (> 1st trimester), <6 visits or <3 ultrasounds; 2) normal: onset in the 1st trimester, 6-13 visits and 3-5 ultrasounds; 3) very high:  $\geq 14$  visits and / or  $\geq 6$  ultrasounds. Multinomial statistical models were used to identify maternal characteristics associated with low and very high care among all and low risk women. Results: 10.5% of women had low care and 33.6% had very high level of care (10.0% and 28.0% for low risk women). Low care was more common in young, foreign-born women and those with low incomes. Unplanned pregnancies and financial difficulties also played a role. Very high use of services was related to parity, migrant status and previous adverse obstetrical history. The results were similar for low risk women. Conclusion: While inadequate care is strongly correlated with maternal socioeconomic characteristics, these factors are not related to the use of a very high level of services. Pregnancy complications explain a small fraction of women with high levels of care.

**Increased risk of early spontaneous abortion among women in first cousin marriages in rural Andhra Pradesh, India****Eastman JM\*, Balasubramanian K, Bunker CH, Tang G, Grubs RE, Basany K, Reddy PS, Haggerty CL  
(University of Pittsburgh, Pittsburgh, PA)**

Background: First-cousin marriages are common practice in many parts of South India. While an increased risk of stillbirth and congenital malformations is well established for consanguineous couples, little is known about the effect on early pregnancy. We sought to determine whether first-cousin marriage was a risk factor for spontaneous abortions (<22 weeks' gestation) and early (<10 weeks' gestation) spontaneous abortions among a rural South Indian population. Methods: A total of 286 women between the ages of 15-35 who had a pregnancy identified at <8 weeks' gestation in the Longitudinal Indian Family Health (LIFE) study were included in this analysis. Cox proportional hazards regression models were used to evaluate the association between first-cousin marriages and risk of early spontaneous abortion, adjusting for maternal age at pregnancy. Results: Overall, 19.9% (57/286) of women reported being in a first-cousin marriage and spontaneous abortion occurred in 12.9% (37/286) of pregnancies. First-cousin marriage was found to be associated with a numerically higher, but not statistically significant, risk of spontaneous abortion (HRadj 1.9, 95% CI 0.9-3.8; p=0.10) and significantly higher risk of early spontaneous abortion (HRadj 2.7, 95% CI 1.1-7.0, p=0.04). Conclusions: Our data show a significant increase in the risk of early spontaneous abortion, a timeframe linked with pregnancy loss due to chromosomal abnormalities, among rural South Indian women in first-cousin marriages. Larger prospective studies of women in consanguineous marriages could confirm our findings, determine the generalizability of our results, and guide counseling for couples seeking to conceive.

**Domains of environmental quality are differentially associated with adverse birth outcomes by levels of urban-rural status****Messer L\*, Rappazzo K, Jagai JS, Lobdell DT  
(Portland State University, Portland, OR)**

Human health is affected by exposures operating from multiple domains across level of urbanicity. To accommodate this, we constructed an environmental quality index(EQI) using data from five domains (air, water, land, built, sociodemographic) for each United States (U.S.) county; counties were categorized by rural-urban continuum codes(RUCC1(most urban) RUCC4(most rural)) for analyses. Using one year (2002) of National Center for Health Statistics birth records (n=3,989,704), fixed slope, random intercept multilevel models were constructed for preterm birth (PTB= birth at <37 weeks completed gestation). Categorical(quintiles) EQI domain-specific RUCC-stratified models were adjusted for maternal age, education, marital status, and infant sex. Across urban-rural categories, poor air quality (5th quintile(Q) of the air domain) was associated with increased PTB odds (odds ratio (OR) for RUCC1-Q5 = 1.18; 95% confidence intervals (95%CI: 1.11, 1.26)) while exposure to more farmland (5th Q land domain) was associated with lower odds of PTB in all but the most rural RUCC strata (RUCC2-Q5 OR= 0.87; 95% CI: 0.81, 0.93). In all but the most urban strata (RUCC1), exposure to poorer sociodemographic conditions (Q5) was also associated with increased PTB odds (RUCC3-Q5 OR=1.34; 95% CI: 1.25, 1.43). Associations with water and built environment domains were inconsistent across rural-urban status. Similar results were found for very PTB, low birth weight (BW) and very low BW outcomes. While some variability was noted by urban-rural residence, consistency of perinatal effect was noted for some domains of environmental quality. This abstract does not necessarily reflect EPA policy.

**Maternal very low birth weights and neonatal outcomes**

**Nweze M\*, David R, Rankin K, Collins J**  
**(John Stroger Hospital, Chicago, IL)**

**BACKGROUND:** A growing body of research links fetal development, reflected by birth weight (BW), with adult health. The developmental origin of health and disease (DOHaD) concept is most thoroughly studied for diabetes, hypertension and heart disease, but recent data also indicates impact of fetal development on reproductive success. **METHOD:** We linked birth records of 251961 infants (born 1989-91) to those of their mothers (born 1956-76). We compared birth outcomes of 997 former very low BW (VLBW, <1500g) women to 233190 normal BW (>2500g) women. **RESULTS:** The rate ratio for having any prenatal medical risk was 1.28 (CI 1.10-1.49) for white women born at VLBW (n=434) and 1.14 (CI 0.99-1.31) for black former VLBW women (n=563). The RR for diabetes in former VLBW women was 2.42 (CI 1.62-3.60) for whites and 2.15 (CI 1.15-4.00) for blacks. The rates for death, preterm birth, LBW, VLBW and small for gestational age (SGA) were increased for both races of infants born to former VLBW women, with RR values consistently higher for white women. Except for PTB for whites and death for blacks, all differences were statistically significant. Slightly lower RR values for both races were seen for former MLBW (1500-2500g) women compared to those for former VLBW women, except for SGA which occurred more often in former MLBW women. Former MLBW women were 18 times as numerous in the maternal population. **CONCLUSION:** Former VLBW survivors tended to have reproductive outcomes modestly worse than MLBW survivors; both groups were at increased risk compared to former normal BW women.

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**Lessons learned from great sociological study of the postpartum care at particular aging sub-society in tsunami affected area in Japan****Yoshida H\*<sup>1</sup>, Harada N<sup>1</sup>, Hayashi K<sup>1</sup>, Arai T<sup>2</sup>, Sugawara J<sup>3</sup>, Abe Y<sup>4</sup>, Ikeda Y<sup>5</sup>, Yokoyama T<sup>1</sup>, Kanatani Y<sup>1</sup>****(<sup>1</sup>National Institute of Public Health, Wako, Saitama, Japan; <sup>2</sup>Kanazawa University; <sup>3</sup>Tohoku Medical Megabank Organization; <sup>4</sup>Abe Maternity Clinic; <sup>5</sup>Otowa Hospital)**

There is a generation inequality in health care of highly aging society like Japan - perinatal health care is less concern than elder care. 10 obstetricians set up a project specialized for pre- and postnatal care, and carried out medical activities in these disaster-stricken areas by taking care of pregnant and postpartum patients from April 1st until July 3rd, 2011. We reported current conditions of maternal and child health care and pregnancy-related care in these afflicted areas as well as brought up a needs assessment. There were 2 pregnant patients in the shelter, 8 in their half-destroyed house 3 weeks after Tsunami. There were 22 pregnant women in another area, 5 of them were evacuated by helicopter to the other prefecture, 8 of them were at the shelter and the rest of them were at the house. Local government lost their network with local health care workers and we reported to them. Most of the pregnant women could not have enough OB care since no crisis response medical team had any OB doctors and midwives in Japan. Those pregnant women feared for being pregnant, and their family pressed them not to give birth and have a baby in this situation. They strongly felt guilty for their babies and were eager to have a person whom they could consult about maternal care and their babies' status. With dispatched specialist (obstetricians and midwives) after natural disaster we built the visiting system and correct birth outcomes and neonatal health outcomes.

**Physical activity and preterm delivery among African American women: Life-course influences on fetal environments study****Sealy-Jefferson S\*, Caldwell C, Osypuk TL, Slaughter J, Straughen J, Dailey R, Helmkamp L, Misra DP****(Wayne State University School of Medicine, Detroit, MI)**

Evidence of the association between physical activity during pregnancy and preterm delivery (PTD) has been building but limited research is specific to African Americans (AAs): a population with increased risk for PTD. Using data from the Life-course Influences on Fetal Environments study (2009-2012), we examined the association between physical activity during pregnancy and PTD (birth before 37 completed weeks of gestation) among postpartum AA women. Using detailed validated questionnaires, we collected information on daily leisure-time PA, walking for a purpose (not physical activity), and stair climbing during pregnancy. The prevalence of PTD was 16.7%. In bivariate log-binomial regression models, women who reported some daily physical activity during pregnancy (37.1%), regardless of duration, had significantly reduced risk of PTD, compared to women reporting none (62.9%) (prevalence ratio (PR): 0.65; 95% confidence interval (95% CI): 0.49, 0.85). Similarly, women who walked for a purpose at least 30 minutes/day (53.4%) had significantly lower prevalence of PTD, compared to those who walked less than 30 minutes/day (46.6%) (PR: 0.66; 95% CI: 0.52, 0.84). Women who climbed stairs greater than three times/day (48.0%) had lower PTD prevalence than those who did not (52.0%) (PR: 0.71; 95% CI: 0.55, 0.91). Importantly, socioeconomic factors were not strongly associated with PTD in our cohort, and are unlikely to confound the reported associations. Future analyses will explore potential mediators and confounders. Different forms of physical activity during pregnancy appear to protect AA women from PTD.

**Physical activity during pregnancy and preterm delivery in African American women: Baltimore Preterm Birth study****Sealy-Jefferson S\*, Hegner K, Helmkamp L, Misra DP  
(Wayne State University School of Medicine, Detroit, MI)**

Traditional risk factors for preterm delivery (PTD) do not account for the increased risk among African American (AA) women. Physical activity (PA) during pregnancy may decrease risk of PTD, but few studies in AAs exist. Using data from a cohort of low-income African American women enrolled from 2000-2004 in the Baltimore PTD Study (n=832), we examined the relationships between PTD and intensity and duration of leisure-time PA as well as stair climbing and walking for a purpose during pregnancy. PTD was defined as birth before 37 completed weeks of gestation. Physical activity data were self-reported during prenatal (n=456) and post-partum (n=376) interviews. The rate of PTD was 16.7%. In unadjusted log-binomial regression models, we found no significant associations between PA, stair climbing or walking for a purpose and PTD. However, in adjusted models (controlling for age, education, illicit drug use, smoking during second trimester, locus of control, and a validated family resources scale), we found a significant decrease in prevalence of PTD for women who walked for a purpose at least 30 minutes per day (prevalence ratio (PR): 0.64, 95% Confidence Interval (CI): 0.43, 0.94), compared to women who walked less than 30 minutes per day. Further, the association between increasing intensity (mild/moderate versus vigorous) of weekly PA and PTD approached statistical significance (PR: 0.42, CI: 0.16, 1.10). These results suggest that walking for a purpose during pregnancy may confer protection against PTD, and add to the current evidence of a protective effect of physical activity on birth outcomes.

**Associations of fish consumption during pregnancy with birth outcomes****Sampson AJ\*, Liu J, Merchant AT, Moran R  
(University of South Carolina, Columbia, SC)**

Data from the 2009-2010 South Carolina Pregnancy Risk Assessment Monitoring System (SC PRAMS) and birth certificate records were used to assess the associations of maternal fish consumption during pregnancy and birth outcomes. In 2009-2010, as a part of National Environmental Public Health Tracking Program, SC PRAMS added state-specific questions to assess the frequency, types, and water sources of fish consumed by mothers during pregnancy. Multiple logistic regression models were used to examine the associations between fish consumption and binary outcomes (low birth weight: <2500g; preterm birth: <37 weeks). Multinomial logistic regression was used for categorical birthweight outcome (small-, average-, or large-for-gestational age). Linear regression models were used for continuous birthweight and duration of gestation. SAS-callable SUDAAN was used. In our sample (unweighted n=791), 6.8% of infants were born at low birth weight and mean birth weight was 3245.4 g ( $\pm 22.7$ ). The percentage of preterm births was 8.3% and mean gestational age was 272.8 days ( $\pm 8.3$ ). Women who consumed fish 4 or more times a month during pregnancy had 1.7 times (95% confidence interval (CI): 1.1, 2.7) higher odds of having a low-birthweight infant than women who didn't eat any fish during pregnancy. After adjustment, the association was attenuated (odds ratio: 1.7, 95% CI: 0.9, 3.1). No significant results were found for other measures of birth outcomes. Fish consumption during pregnancy was not associated with increased birth weight and gestational duration. Further investigation is needed to confirm these conclusions, as there are inconsistencies with the current research.

**The impact of life course body weight on fetal growth**

**Straughen JK\*, Caldwell CH, Osypuk TL, Slaughter JC, Sealy-Jefferson S, Helmkamp L, Dailey R, Misra DP  
(Wayne State University School of Medicine, Detroit, MI)**

Few studies have examined how life course body weight impacts fetal growth. We examined the relationship between maternal life course body weight and gestational age adjusted birthweight in a cohort study of preterm birth in Black women in Southfield, Michigan (N=1411; 71% response rate). Data about three time periods (birth, age 18, prepregnancy) were obtained from maternal interview and medical record abstraction. Percentiles of maternal body weight were calculated from the sample distributions at each time point. Percentiles of infant birthweight for a given gestational age were calculated using a reference standard generated from the 1999-2000 US Natality datasets. Prevalence ratios (PR) and 95% confidence intervals (CI) were calculated using log-binomial models. Six maternal weight percentile trajectory groups were estimated and classified based on the trajectory's beginning and endpoint (high-high, high-medium, high-low, low-high, low-medium, low-low). The proportion of SGA infants (birthweight less than the 10th percentile) differed across the trajectory groups ( $p < 0.0001$ ) as did the proportion of infants with birthweights above the 90th percentile (LGA;  $p < 0.0001$ ). Regardless of the endpoint, trajectories that started low had higher rates of SGA offspring (low-medium, 16.18%; low-high, 17.24%; low-low, 23.30%). When compared to the high-medium group, the low-low group had higher prevalence of SGA (PR=2.03 95% CI=1.39, 2.94). Conversely, starting high or ending medium to high was associated with higher rates of LGA. The high-high trajectory group had the highest proportion LGA infants (11.38%), followed by the high-medium group (7.99%). These results suggest that body weight across the life course impacts fetal growth.

**Distance to the closest maternity unit and risk of fetal and neonatal death in France**

**Pilkington H, Blondel B, Drewniak N, Zeitlin J\***  
(INSERM, UMRS 953, Epidemiological Research Unit on Perinatal and Women's and Children's Health, Paris, France)

Objective: Maternity closures in France have raised concerns about the accessibility of maternity services and impact on perinatal health. We investigated the association between distance to the closest maternity unit and perinatal mortality. Methods: Fetal and neonatal mortality rates, constructed from vital statistics over the period 2001 to 2008, were analyzed by distance between the mother's municipality of residence and the closest municipality with a maternity unit. Distance calculations were based on the road network. We also computed the rate of neonatal deaths occurring after out-of-hospital delivery. Risk ratios were adjusted for multiplicity, maternal age, parity and municipal socio-demographic characteristics. Results: 7% of births occurred to women residing at  $\geq 30$ km from a maternity unit and 1% at  $\geq 45$ km. Fetal and neonatal mortality rates were highest at  $< 5$  km from a maternity unit. Fetal mortality increased at  $\geq 45$ km compared with 5-44 km. In adjusted models, long distances had no impact on mortality; living close to a maternity unit and more municipal unemployment and foreign born residents were associated with increased mortality. Neonatal deaths following out-of-hospital delivery were rare (4.5 per 100 000 births), but occurred more often at  $\geq 45$ km compared with  $< 5$  km (relative risks: 2.8 (1.1-7.2)). Conclusion: Overall mortality was not associated with living far from a maternity unit, although there were more deaths after out-of-hospital delivery. Mortality was elevated in municipalities with social risk factors and located closest to a maternity unit. This latter result could reflect location of maternity units in deprived areas with risk factors for poor outcome.

**The influence of personal- and group-level interpersonal racism on entry into prenatal care among African American women****Slaughter JC\*, Caldwell CH, and Misra DP****(Michigan State University, Department of Epidemiology & Biostatistics, College of Human Medicine, East Lansing, MI)**

Racism has been hypothesized as a barrier to accessing healthcare. No quantitative study has directly assessed its influence on women's initiation of prenatal care (PNC). We examined the relationship between personal- and group-level lifetime interpersonal racism, and PNC entry among low-income African American women. We also examined whether women's responses to discrimination modified this relationship. Using a prospective/retrospective cohort design we collected data from 841 African American women (prenatally: n=459; postpartum: n=384). Modified Poisson regression was used to assess the relationship between lifetime interpersonal racism and late or no PNC entry. PNC entry was not significantly associated with personal-level interpersonal racism ( $p=0.33$ ); it was significantly associated with group-level ( $p<0.01$ ). Response to discrimination significantly ( $p<.001$ ) modified the association between group-level interpersonal racism on late PNC entry. Compared to women who acknowledged group-level interpersonal racism and reported an externalized response, women who internalized discrimination and denied group-level interpersonal racism were more likely enter PNC late (Prevalence Ratio=1.51, 95% CI:1.07-2.14). The opposite was true for women who acknowledged group-level interpersonal racism and internalized (Prevalence Ratio=0.49, 95% CI: 0.29-0.84). Denial of interpersonal racism experienced by others was a barrier to early PNC among low-income African American women, especially those who internalized their own response to discrimination. Delayed access to PNC may be rooted in the avoidance of racialized experiences among less empowered women when faced with discrimination. Our findings have important implication for the engagement of African American women into the PNC delivery system and the health care system postpartum.

**Comparing weighted dose-response curves for the relation between maternal education and the risk of preterm birth in native- and foreign-born Quebec mothers****Naimi AI\*, Auger N, Moodie EEM, Kaufman JS  
(McGill University, Montreal, QC)**

Dose-response curves (DRC) provide important information on the shape of the exposure-outcome relation across the exposure's range. Unadjusted and conditional DRCs are subject to confounding and selection bias, respectively. Weighted DRCs can be fit using inverse-probability of exposure weights, and are unbiased when the exposure model is correctly specified. We fit three generalized additive models (GAMs) using penalized regression splines with smoothing parameters estimated using generalized cross validation, and plotted the log-risk of preterm birth (PTB) as a smooth function of the number of years of maternal education: an unadjusted GAM; a GAM adjusted for relevant confounders; and an inverse probability of exposure weighted GAM. We use birth registry information with data on 1.3 million live singleton births in the province of Quebec, Canada, between 1989 and 2008, and compare the DRCs obtained using each GAM between foreign- and native-born mothers. Exposure and confounder information was obtained using questionnaire responses available in the birth file. Measured confounders included maternal and paternal age and country of birth, mother tongue, language spoken at home, parity, and a small-area index of material deprivation. The mean (SD) number of years of attained education was 13.7 years (3.1). The proportion (SD) of PTB was 0.09 (0.29). Overall, each DRC revealed similar points at which the log-risk of preterm birth crosses the null (13 years of education), suggesting an important protective effect of greater than high-school education. Other features, however, (such as min and max risk) varied markedly by DRC type and sub-group.

**Psychosocial stress during pregnancy and length of gestation****Shapiro GD\*, Seguin JR, Fraser WD****(CHU Sainte-Justine Research Centre, Universite de Montreal, Montreal, Canada)**

Background Preterm birth (PTB) is a significant and growing public health problem leading to increased neonatal morbidity and mortality and entailing substantial social and economic costs. Evidence suggests infants born at up to 39 weeks are at increased health risks during the neonatal period and into childhood. A growing literature supports the role of psychosocial stress during pregnancy (PSP) in the etiology of reduced gestational length. This study aims to describe the associations between PSP and shortened gestation in a Canadian cohort. Methods We followed 2456 women from the first trimester of pregnancy through delivery. Data were collected from interview-assisted questionnaires (baseline characteristics and medical history), self-reported questionnaires at three timepoints during pregnancy (psychosocial stress exposures) and by chart review at delivery. Stress exposures included stressful life events during pregnancy and their perceived impact, general perceived stress, pregnancy-specific anxiety, and marital strain. Results Based on preliminary data from 1535 subjects, perceived stress and pregnancy anxiety at third trimester were weakly but significantly inversely associated with gestational age at birth (perceived stress: Pearson  $r=-.11$ ,  $p<.001$ ; pregnancy anxiety:  $r=-.08$ ,  $p<.001$ ). In examination of dichotomous outcomes, first-trimester marital strain and third-trimester perceived stress predicted delivery at  $<37$  weeks (marital strain:  $F=6.28$ ,  $p=.012$ ; perceived stress:  $F=5.57$ ,  $p=.018$ ). Birth before 39 weeks was significantly predicted by perceived impact of stressful life events at second trimester ( $F=4.13$ ,  $p=.042$ ) and perceived stress ( $F=6.77$ ,  $p=.009$ ) and pregnancy anxiety ( $F=4.92$ ,  $p=.027$ ) at third trimester. Conclusions Preliminary data suggest some measures of psychosocial stress to be associated with shortened gestation.

**Public and private prenatal care service and pregnancy endpoints in a country with universal access to care****Correia S\*, Barros H  
(Institute of Public Health - University of Porto)**

Objective: To assess the effect of prenatal care (PNC) setting on the occurrence of pregnancy complications and subsequent pregnancy outcomes. Methods: Women delivering a live birth in 5 level III maternities were invited to integrate the Generation21 Portuguese birth cohort. In 2005/06, structured face-to-face interviews collected data on maternal socio-demographics, obstetric history, lifestyles and PNC. Pregnancy complications and adverse outcomes were retrieved from the clinical records. Exposure: exclusive public (n=4467) vs. private care (n=1978), stratified by pre-pregnancy risk profile (low and high-risk). Outcomes: inadequate weight gain, smoking continuation, diagnosis of gestational hypertension or diabetes and c-section, preterm, low birth-weight and small and large-for-gestational-age. Confounders: maternal socio-demographics (age, education, income, parity). Results: Private care users showed better socioeconomic indicators, a more favorable pre-pregnancy risk profile and entered PNC earlier and had more visits, ultrasounds and blood tests. Within low-risk, women using private care were, compared to public users and independently of socio-demographics, less likely to continue smoking (OR=0.54; 95%CI: 0.33-0.88), to gain weight above the recommendation (OR=0.76; 95%CI: 0.64-0.90) and to present gestational diabetes (OR=0.65; 95%CI: 0.47-0.90). Pregnancy outcomes were similar with the exception of a lower likelihood of delivering small-for-gestational age babies (OR=0.71; 95%CI: 0.57-0.90). In high-risk women, no differences were found in pregnancy complications according the setting of care but private users were more likely than public ones to have a preterm delivery (OR=1.84; 95%CI: 1.18-2.86). Conclusion: Despite women's more disadvantaged social and clinical profile and the lower amount of care, public PNC attenuated most inequalities in pregnancy outcomes.

**Effects of racism on risk for preterm birth**

**Misra DP \*, Caldwell CH, Osypuk TL, Sealy-Jefferson S, Slaughter JC, Straughen JK, Helmkamp L, Dailey R  
(Wayne State University School of Medicine, Detroit, MI)**

Few published studies have examined racism as a risk factor for preterm birth (PTB), despite the persistence of racial disparities in PTB. We sought to examine the relationship between measures of perceived racism and PTB. Data were obtained from a cohort study of PTB among Black women in Southfield, Michigan (N=1411; 71% response rate; 16.4% PTB) using maternal interviews and medical record abstraction. The Daily Life Experiences of Racism and Bother (DLE-B) scale measured how often racism occurred in the past year (never; <once a year; a few times a year; about once a month; a few times a month; once a week or more) together with how much it bothered the respondent (never; not at all; a little; somewhat; a lot; extremely). Related measures included the Major (Lifetime) Experiences of Discrimination, Black Identity, and Response to Racism Experiences scales. We found a nonlinear bivariate effect of only the DLE-B scale (range 20-637) on PTB risk; subjects in the scale's second quartile exhibited higher PTB risk than subjects with very high or low scores (prevalence ratio, 95% confidence interval: 1.64, 1.16-2.32). We further explored this nonlinearity by utilizing restricted cubic splines which fit our data better than a linear model. The spline shows an estimated PTB prevalence of about 13% for respondents reporting no past-year racism, increasing to 20% prevalence for those with intermediate DLE-B scores, and decreasing again for those with higher scores. These findings add to the small body of literature examining racism and preterm birth.

**A100**

**Relation of the content of prenatal care to feelings of discrimination in African American women**

**Hill T, Slaughter J, Misra DP\***

**(Wayne State University School of Medicine, Detroit, MI)**

Studies have shown African American (AA) women to have lower rates of prenatal care utilization and questions have arisen about quality of the care. Prenatal care quality may relate to feelings of racial discrimination. Experiences of racism even outside of care may prevent a good patient-provider relationship and not allow for the woman to be fully engaged. Using interview data from low-income AA women enrolled from 2000-2004 in the Baltimore PTD Study (n=855), we examined the relationships between prenatal care quality as measured by reports of key topics discussed in care and perceived racism during pregnancy. Women who reported being treated rudely because of their race were less likely to report their provider talking to them about vaginal bleeding (rate ratio (RR), 95% confidence interval (CI): 0.91, 0.84-0.99), douching (RR, 95% CI: 0.95, 0.90-1.00) or partner violence (RR, 95% CI: 0.94, 0.89-0.99). Women who reported being treated like they were stupid or talked down to because of their race were less likely to report their provider talking to them about bleeding (RR, 95% CI: 0.90, 0.82-0.98), douching (RR, 95% CI: 0.90, 0.85-0.97), or baby's movement slowing (RR, 95% CI: 0.92, 0.85-1.00). Women who reported ever experiencing racism compared to those who denied any experience were less likely to report their provider talking to them about family problems (RR, 95% CI: 0.81, 0.69-0.94). Our results suggest the need to explore how the history of a woman's experiences of racial discrimination may affect her experience of prenatal care.

**A101**

**International comparison of common risk factors of preterm birth between the U.S. and Canada, using PRAMS and MES (2005-2006)**

**Nagulesapillai T\*, Garn JV, Metcalfe AL, Kramer MR, Tough SC  
(Department of Community Health Sciences, Faculty of Medicine, University of Calgary)**

Background: Preterm birth (PTB; birth 28-37 weeks gestation) is a leading cause of newborn deaths and morbidities. The Maternity Experiences Survey (MES) from Canada was modeled from the Pregnancy Risk Assessment Monitoring System (PRAMS) from the U.S., allowing for an international comparison of risk factors for preterm birth and the assessment of relative influence of these risk factors. Methods: The prevalence of preterm birth by common risk factors, along with risk ratios and the population attributable fractions (AF) were calculated for several modifiable and semi-modifiable risk factors of PTB. The AF is a measure of the preterm birth burden--the portion of PTB that could be removed by completely eliminating a modifiable risk factor. All measures were compared between the U.S. and Canada. Results: The weighted rate of PTB among singleton infants 28-37 weeks gestation was 7.6% in the US and 4.9% in Canada. Caesarean delivery, extremes in BMI, previous PTB birth and smoking during pregnancy were all associated with greater risk of PTB in both U.S. and Canada. In the U.S., 18.2% of PTB was attributable to caesarean delivery, 4.2 % to extremes in BMI, 13.3% to previous PTB birth, 5.1% to smoking, and 6.7% to income  $\leq$ \$20,000, whereas in Canada, 13.8% was attributable to caesarean delivery, 14.8 % to extremes in BMI, 9.7% to previous PTB birth, 5.5% to smoking and 2.9% to income. Conclusions: Comparing modifiable and semi-modifiable risk factors of PTB in similarly developed countries may help to develop innovative solutions to reduce the burden of PTB.

**A102**

**Evolutions in fetal and neonatal mortality in European countries: Results from the Euro-Peristat project**

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Objectives 2004 data from the Euro-Peristat project documented wide variations in fetal and neonatal mortality rates in Europe. We sought to evaluate whether mortality rates had declined in 2010 and whether these declines reduced inequalities between countries. Methods Aggregated data on live births, fetal and neonatal deaths by gestational age from 25 participating countries in 2004 and 2010 were used to compute fetal and neonatal mortality rates using common inclusion thresholds ( $\geq 28$  weeks of gestation for fetal deaths and  $\geq 24$  weeks of gestation for neonatal deaths). Results In most countries, fetal and neonatal mortality rates declined, but decreases differed in magnitude. Neonatal mortality rates declined between 0% and 55% (average 18%) and fetal mortality rates between 0% and 39% (average 13%). Reductions tended to be more pronounced for countries with higher mortality rates in 2004, but some countries with low mortality rates achieved significant continued improvements in outcomes. Wide variations in mortality rates persisted in 2010, with countries with highest mortality rates having two times higher rates compared with those with lowest mortality rates. Conclusions Fetal and neonatal mortality rates have declined in European countries, even in those with very low rates in 2004, but disparities have persisted. Investigation of health care policies and practices in high performing countries could provide insight into effective strategies for improving perinatal health outcomes.

**A103**

**Risk factors of newly onset anxiety during pregnancy**

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Background: Anxiety is a common mental health problem during pregnancy and is associated with adverse maternal and child sequelae. A better understanding of risk and protective factors is essential for implementing preventive strategies. The aim of this study is to determine demographic, obstetric, and psychosocial factors of newly onset anxiety in pregnancy. Methods: A secondary analysis of data collected through the All Our Babies study, a community-based prospective study in Calgary, Alberta was conducted. The sample consisted of 2205 pregnant women without a history of mental health problem and was divided as follows: no anxiety, transitional anxiety (at 2nd OR 3rd trimester), and chronic anxiety (both 2nd AND 3rd trimester). Three separate multiple logistic regression analyses were used to examine contributing factors for each anxiety group. Results: Partner tension was the consistent predictor of antenatal anxiety across the groups (AOR, 2.23 to 3.94). Factors associated with chronic anxiety were low social support (AOR 4.60; 95% CI:2.78,7.60), low income (AOR 2.79;95% CI:1.49,5.23), and being primigravida (AOR 1.63; 95% CI:1.04,2.55).Transitional anxiety at the 2nd trimester was associated with older maternal age, being primigravida or new in Canada, and having a history of abuse or neglect. Younger age (<25;AOR2.70; 95% CI:1.40,5.20) and low social support (AOR 1.88; 95% CI:1.14,3.09) were significant risk factors of transitional anxiety at the third trimester. Implications: Different factors contribute to transitional and chronic anxiety during pregnancy. Findings of this study can inform further development of guidelines to identify anxious women at various stages of pregnancy.

**Correlates of suboptimal gestational weight gain in Nova Scotia, 2003-2010****Woolcott CG\*, Dodds LD  
(Dalhousie University, Halifax, NS, Canada)**

Inadequate and excessive gestational weight gain (GWG) is prevalent. Our objective was to examine the association between suboptimal GWG and maternal characteristics. Data on singleton pregnancies from 2003-2010 were obtained from the population-based Nova Scotia Atlee Perinatal Database into which maternal weight and height are entered from standard provincial records. GWG, the difference between delivery and prepregnancy weight, was categorized according to recommendations. Characteristics examined in relation to GWG included maternal age, marital status, area-level income, parity, prepregnancy body mass index (BMI), smoking, antidepressant use, and fetal sex. Odds ratios (ORs) with 95% confidence intervals (CI) adjusted for age, parity, and BMI were calculated using multiple logistic regression. Among 36,571 pregnancies, GWG was inadequate in 15.4%, excessive in 58.4%, and adequate in 26.2%. Characteristics associated with excessive GWG included being unmarried, primiparity, prepregnancy overweight or obesity, smoking, using antidepressants, and carrying a male fetus. The ORs for excessive GWG in overweight and obese women relative to normal weight women were 2.6 (CI: 2.4-2.8) and 2.3 (CI: 2.1-2.5), respectively. Characteristics associated with inadequate GWG included higher maternal age, being unmarried, low income, multiparity, prepregnancy underweight, smoking, and antidepressant use. In subsequent pregnancies, GWG in the previous pregnancy was strongly related with the odds of suboptimal GWG. Some factors, particularly prepregnancy BMI, were associated with excessive GWG, suggesting that women at higher risk can be identified in early pregnancy. However, excessive GWG was also prevalent among women without these factors. All women may need support throughout pregnancy to optimize GWG.

**Neighborhood predictors of small and large birth size: Food, physical activity, alcohol, and tobacco resources**

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**BACKGROUND:** Neighborhood context may influence small or large birth size through maternal diet, obesity, stress, and smoking and alcohol use. Yet prior research has focused on neighborhood predictors of small birth size, with little focus on the other end of the birth size continuum. **METHODS:** We linked Oregon Pregnancy Risk Assessment Monitoring System data (PRAMS; 2004-2007, Portland Metropolitan Area, n=3,930) to neighborhood features within 3km of each residence using a Geographic Information System. PRAMS includes race/ethnic oversamples and is weighted for state representation. Using multinomial logistic regression, we estimated effects of neighborhood deprivation and availability of food stores, restaurants, exercise facilities, and tobacco and alcohol outlets (counts per 10,000 population) on small or large (compared to appropriate) for gestational age (SGA, LGA, AGA), controlling for individual-level sociodemographic characteristics. **RESULTS:** Women living in neighborhoods with greater availability of fast food restaurants had greater odds of having an SGA baby [OR (95% CI): 3.0 (1.5, 5.8)], while availability of tobacco outlets was related to lower odds of SGA [OR (95% CI): 0.5 (0.2, 1.1)]. Neighborhood deprivation was related to greater odds of SGA and LGA [OR (95% CI): 1.4 (1.0, 2.1) and 1.8 (1.2, 2.8), respectively]. Greater supermarket availability was marginally associated with LGA. Availability of convenience stores, exercise facilities, and alcohol outlets were unrelated to SGA and LGA. **CONCLUSION:** SGA and LGA were associated with different types of neighborhood resources, suggesting differing behavioral and psychosocial pathways. Understanding these potentially competing mechanisms is critical for understanding how neighborhood context impacts birth outcomes.

**Depressive/anxiety symptoms and their association with preterm delivery and hypertensive disorders during pregnancy****Thombre MK, Talge NM, & Holzman C  
(Michigan State University)**

Results from studies on maternal depression/anxiety and hypertensive disorders during pregnancy are inconsistent. The purpose of this analysis was to examine whether the proximity of depression/anxiety symptoms to pregnancy helps inform this area of study. The present analysis includes 1,365 women from the Pregnancy Outcomes and Community Health (POUCH) Study who provided interview data at enrollment (16-27 weeks) and had information on hypertensive disorders abstracted from medical records. The exposure measure, depression/anxiety, was self-reported according to five timepoints in the lifecourse: within the past week (CES-D scores), since last LMP, one year prior to pregnancy (PPDA-LastYear), and lifetime history (PPDA-Ever). A 4-level outcome measure was constructed with timing of delivery (FTD: full-term delivery; PTD: preterm delivery) and hypertensive disorder status (HTN: yes, no) (referent: FTD, no HTN). All models used weighted polytomous logistic regression. Additional analyses examined whether particular HTN disorders (PE: preeclampsia, GTN: gestational hypertension, CH: chronic hypertension) were linked to maternal depression/anxiety. Following adjustment for maternal socio-demographics, smoking, and pre-pregnancy BMI, PPDA-LastYear (aOR=2.7, 95% CI 1.3, 5.3) and PPDA-Ever (aOR=2.5 95% CI 1.4, 4.4) were significantly associated with the combination of HTN and PTD. These associations were driven by PE and CH (aORs: 2.4-5.0). Anti-depressant use was unrelated to PTD and HTN and inclusion did not alter the above findings. Pre-pregnancy, but not current, symptoms of depression/anxiety may be linked with an increased risk of PTD along with HTN disorders. A life-course perspective may be necessary to elucidate how these phenomena are related to pregnancy outcomes.

A107

**Pregnancy-related weight in Nova Scotia: 2003-2010**

**Woolcott CG\*, Ashley Martin J, Dodds L  
(Dalhousie University, Halifax, NS, Canada)**

The objective of this study was to describe three aspects of pregnancy-related weight: prepregnancy body mass index (BMI), gestational weight gain (GWG), and postpartum weight retention (PPWR). Data from 2003-2010 were obtained from the population-based Nova Scotia Atlee Perinatal Database, into which maternal weight and height were entered from standard forms. GWG, the difference between delivery and prepregnancy weight, was categorized according to current recommendations. PPWR was calculated as the difference in prepregnancy weights in women with consecutive pregnancies. PPWR and the amount of change needed to achieve recommended BMI and GWG were described with medians and interquartile ranges (IQR). Nearly half (48.8%) of the 42,033 pregnancies were in women with recommended prepregnancy BMI (18.5-24.9). In the 47.4% of pregnancies in women with BMI>25, the median (IQR) weight loss that would have been required for the recommended BMI was 12.2 kg (5.3 to 22.5). Recommended GWG was achieved in 26.2% of 36,571 singleton pregnancies. The median (IQR) difference in GWG that would have been required to be within recommendations was -4.8 kg (-8.6 to -2.2) among the 58.4% pregnancies with excessive GWG and 2.1 kg (0.9 to 4.0) among the 15.4% pregnancies with inadequate GWG. The median (IQR) PPWR between 17,206 pairs of consecutive pregnancies was 2.3 kg (-0.9 to 6.8). Recommended prepregnancy BMI and GWG were observed in fewer than 50% of pregnancies, and many women experience weight gain between pregnancies. Excessive pregnancy-related weight likely contributes considerably to adverse perinatal outcomes and lifelong maternal weight gain trajectories.

**Risk of recurrent gestational diabetes among migrants in New Jersey, 1999-2003**

**Janevic T\*, Loftfield E, Echeverria S**  
(UMDNJ School of Public Health, Department of Epidemiology)

The risk of recurrent gestational diabetes among migrants has not previously been studied. The objective of this study was to examine the risk of gestational diabetes and recurrent gestational diabetes among the four most populous foreign-born groups in New Jersey (Puerto Ricans, Dominicans, Mexicans, and South Asians) relative to non-Hispanic U.S. born whites using maternally linked birth and hospital discharge data from the years 1999-2003. We selected pairs of singleton live births to primiparous women without existing diabetes (n=73,962 births). Cases of gestational diabetes were ascertained using a combination of the birth certificate and hospital record. To estimate associations between migrant group and risk of gestational diabetes, we calculated relative risks adjusted for maternal age and education using log-binomial regression. Among women with gestational diabetes in the index pregnancy, we estimated the risk of recurrent gestational diabetes in the second pregnancy. Among primiparous women, all immigrant groups were at an increased risk of gestational diabetes (aRR for Dominicans=1.3, 95%CI=1.1, 1.5; aRR for Puerto Ricans=1.9, 95%CI=1.6, 2.3; aRR for Mexicans=1.4, 95%CI=1.2, 1.6; aRR for South Asians=3.8, 95%CI=3.5, 4.1) relative to non-Hispanic whites. The overall risk for recurrent gestational diabetes was 39%. Only Mexican women were at an increased risk for recurrent gestational diabetes (aRR=1.8, 95%CI=1.3, 2.5) relative to non-Hispanic whites. Contrary to the Hispanic paradox, we found an increased risk of gestational diabetes among all Hispanic migrant groups, and an increased risk of recurrent gestational diabetes among Mexican women. Modifiable risk factors for recurrent gestational diabetes among Mexican migrants should be explored.

**A109**

**Low birth weight, small-for-gestational age and preterm births before and after the economic collapse in Iceland**

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**(Centre of Public Health Sciences, University of Iceland)**

Objective: To assess the potential effect of the 2008 national economic collapse in Iceland on the risks of adverse birth outcomes. Methods: All Icelandic women giving birth to live-born singletons from January 1st 2006 to December 31st 2009 were included. LBW infants were defined as those weighing <2500 grams at birth, PB infants as those born before 37 weeks of gestation and small for gestational age (SGA) as those with a birth weight for gestational age more than 2 standard deviations below the mean according to the Swedish fetal growth curve. We used logistic regression analysis to estimate odds ratios [OR] and corresponding 95 percent confidence intervals [95% CI] of adverse birth outcomes by exposure to calendar time of the economic crisis. Results: Compared to the preceding period, we observed increased odds in LBW deliveries following the economic collapse (aOR=1.24, 95% CI [1.02, 1.52]), particularly among infants born to mothers younger than 25 years (aOR=1.85, 95% CI [1.25, 2.72]) and not working mothers (aOR=1.61, 95% CI [1.10, 2.35]). Similarly, we found a tendency towards higher incidence of SGA births (aOR=1.14, 95% CI [0.86, 1.51]) particularly among children born to mothers younger than 25 years (aOR=1.87, 95% CI [1.09, 3.23]) and to not working mothers (aOR=1.86, 95% CI [1.09, 3.17]). No change in risk of PB was observed. Conclusions: The results suggest an increase in risk of LBW after the dramatic collapse of the Icelandic national economy, which seems to be driven by reduced fetal growth rate rather than shorter gestation.

A110

**Immortal time bias in the study of stillbirth risk factors: The example of gestational diabetes**

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Objectives: Immortal time refers to a period of time when, by design, the study outcome cannot occur. The goal of this study was to describe the theoretical potential for immortal time bias in studies of stillbirth risk factors and to quantify the magnitude of this bias, using the example of gestational diabetes mellitus (GDM). Methods: We used previously-described conditions for immortal time bias to evaluate the theoretical potential for bias in studies of stillbirth risk in GDM. We assessed the magnitude of the bias by calculating the relative risk (RR) of stillbirth 1) after 20 weeks' gestation (the age at which live birth registration begins) and 2) after restricting the cohort to >28 weeks (when GDM screening is completed) using 2006 United States vital statistics records (n=2,001,749). Results: Conventional studies of stillbirth risk in GDM are susceptible to immortal time bias because although cohorts typically include all births >20 weeks' gestation, pregnancies must survive until 24-28 weeks in order to be screened and diagnosed with GDM. As a result, the numerators for stillbirth risk in non-GDM pregnancies includes all stillbirths  $\geq 20$  weeks, but only stillbirths >24-28 weeks in GDM pregnancies. Analysis of US birth data showed that GDM appeared to be protective against stillbirth when including all births (RR=0.88 [95% CI 0.79, 0.99]), but after restricting to >28 weeks, GDM had an increased risk of stillbirth (RR=1.25 [95% CI 1.11, 1.41]). Conclusion: Immortal time prior to GDM diagnosis may bias our understanding of the stillbirth risk associated with this condition.

**A111**

**Comparison of the Prenatal Psychosocial Profile and the Perceived Stress Scale in identifying women with high perceived stress**

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Objective: To compare the number of women with a score in the top 25% on the Perceived Stress Scale (PSS) in relation to the Assessment of Stress portion of the Prenatal Psychosocial Profile (PPP). Methods: Secondary data analysis on an original cohort of 301 women from the New Orleans and Baton Rouge areas who were exposed to Hurricane Katrina and its aftermath. A cross-sectional assessment of 187 women who completed both the Prenatal Psychosocial Profile (PPP) and Perceived Stress Scale (PSS) was completed. The mean score and the number of women scoring in the third quartile for each instrument were compared. Results: There was not a statistically significant difference between the numbers of women scoring in the third quartile between the two tests. There were 30 discordant scores found resulting in a Kappa Coefficient of 0.50 (95% CI 0.35-0.66). Both tests were positively and significantly correlated with depression as measured by the Edinburgh Depression Scale. When the mean of the PSS was compared to the means of normed populations, women in our sample scored higher, but not statistically significantly higher, than normed scores of each test. Conclusions: Screening with the PSS identifies similar women compared to the PPP. Studies should assess the need to use both instruments to measure stress in pregnant women.

A112

**Seasonal variation of total 25-hydroxyvitamin-D in a pooled sample of black and white pregnant women from three U.S. pregnancy cohorts**

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Background: Serum concentration of 25-hydroxyvitamin-D (25OHD) varies within individuals and across populations seasonally. We evaluated seasonal variation of 25OHD (25OHD3 and 25OHD2) among pregnant women, focusing on pattern and determinants of variation. Methods: 2,583 non-Hispanic Black and White pregnant women in a multi-center case-control study nested within three cohorts had antenatal 25OHD concentrations determined using mass spectrometry. Fourier time series analysis and generalized linear models were used to confirm and estimate magnitude of 25OHD seasonal variation. We modeled seasonal variability of 25OHD using a stationary cosinor model to estimate the phase shift, peak-trough difference (PT $\Delta$ ), and annual mean (AM). We repeated analyses for 25OHD3 and 25OHD2 and by race and study site. Results: We observed a seasonal pattern for 25OHD, with a peak in summer, a nadir in winter, and a phase of 8 months, when the seasonal increase is symmetric to the decrease. The pattern was due to fluctuations in 25OHD3 with no evidence of seasonal variation in 25OHD2. After adjustment for study site, maternal age, and gestational age at sample collection, the AM concentrations and the estimated PT $\Delta$  of 25OHD among Black women were 19.6 (95% confidence interval [CI]: 18.9-20.4), and 5.9 (95%CI: 4.9-7.0 ng/mL), and 33.0 (95%CI: 32.6-33.5) and 7.1 (95%CI: 5.6-8.6 ng/mL) for White women. Seasonality in 25OHD varied by maternal educational attainment and pre-pregnancy obesity, but not study site. Discussion: Seasonal variability 25OHD among pregnant women was observed. Black women had lower 25OHD concentrations throughout the year and lower levels of seasonal variation than Whites.

A113

**Validation of obstetric estimate on the U.S. birth certificate: Results from two population-based samples**

**Dietz PM\*, Bombard J, Hutchings Y, Gauthier J, Gambatese M, Ko JY, Martin J, Callaghan WM  
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The birth certificate variable, obstetric estimate of gestational age (OE), has not been previously validated against gestational age based on the clinician's estimated date of delivery (EDD). We examined the validity of OE using EDD as the gold standard in two population-based samples originating from the Pregnancy Risk Assessment Monitoring System. The first sample included 586 live births delivered in New York City (NYC) during January - June 2009. The second sample included 649 live births delivered in Vermont during January-August 2009. Trained abstractors obtained the EDD from the prenatal record when available (64.8% in NYC and 94.6% in Vermont), or when not available, from the hospital delivery record. We estimated sensitivity, specificity, and positive predictive value (PPV) and corresponding 95% confidence intervals (CI) for preterm delivery (<37 weeks gestation). Weights were applied to account for non-response and sampling design. The preterm delivery rate based on EDD was 9.7% (95% CI 7.6-12.4) in NYC and 6.8% (5.4-8.4) in Vermont; based on OE it was 8.2% (6.3-10.6) in NYC and 6.3% (5.1-7.8) in Vermont. In NYC, sensitivity of OE-based preterm delivery was 82.5% (69.4-90.8), specificity was 98.1% (96.4-99.1) and PPV was 98.0% (95.2-99.2). In Vermont, sensitivity of OE-based preterm delivery was 93.8% (81.8-98.1), specificity was 100% and PPV was 100%. OE-based preterm delivery had high specificity and PPV in both samples. Sensitivity was lower in NYC, however prevalence estimates 95% CIs overlapped. These results suggest OE-based preterm delivery has high validity and is useful for the surveillance of preterm delivery.

**Assessing overfitting in perinatal clinical prediction models: The contributions of variable coding, variable selection and parameter estimation**

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Overfitting and optimism in performance are significant considerations in the development and validation of a clinical prediction model. Theoretical evidence has demonstrated that stepwise variable selection methods can lead to overfitting but this is only one phase of the development process that may contribute to model optimism. Using data from the miniPIERS (Pre-eclampsia Integrated Estimate of RiSk) study, our objective was to assess the contribution of three stages of model development ((1) variable coding (transformations and categorizations) (2) variable selection; and (3) parameter estimation) to model optimism. The miniPIERS model was developed in a population of 2081 women (261 adverse outcomes) in 5 LMIC countries. Optimism was assessed by comparing the area under the receiver operating characteristic curve (AUROC) for the original model with the AUROC from 200 bootstrapped samples. Optimism was estimated for: (1) all model development steps (1-3 above); (2) variable selection and parameter estimation only; and (3) parameter estimation only. Results were compared with the change in AUROC when the model was applied to an external dataset. The AUROC for the original model was 0.753 (95% CI 0.719 - 0.786). The average optimism from steps 1 to 3 was 0.034, 0.014, and 0.012, respectively and the AUROC of the model in an external dataset was 0.700 (95% CI 0.628 - 0.766). Bootstrapping procedures to estimate model performance and optimism of clinical prediction models may need to include variable coding as well as variable selection and parameter estimation to capture all aspects of overfitting.

A115

**Impact of under-ascertaining comorbid conditions at delivery on estimated disease prevalence in a pregnant population**

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Background: Hospital billing data for delivery is frequently used to assess maternal comorbidity status. Increasing the length of the observation period for identifying comorbidities in hospital billing data can increase ascertainment; however, as many women of childbearing age will not be hospitalized except for delivery this may still under-ascertain the prevalence of comorbid conditions. Methods: Clinical and administrative databases from Alberta Canada were linked to create a population-based cohort of pregnant women who delivered a live or stillborn infant in hospital (n=6026). Comorbidities were identified in administrative data for the delivery hospitalization and for all health care contacts (hospitalizations, emergency room visits and physician visits) that occurred during pregnancy and three months prior to conception. Results: More than one third (36.7%) of women had at least one health care contact during pregnancy or just prior to conception that indicated the presence of a comorbid condition; approximately one-third of these were not documented the birth hospitalization record. Prevalence estimates increased for all comorbidities when the ascertainment period and number of ascertainment sources increased (i.e. prevalence of asthma increased from 0.2% to 3.1%, prevalence of type 1 or 2 diabetes increased from 0.8% to 5.8%, and prevalence of pre-eclampsia increased from 1.5% to 5.0%). Conclusions: A substantial proportion of comorbidities are not documented during the delivery hospitalization. Prevalence estimates based exclusively on the delivery record systematically under-estimate the frequency of comorbid disease in a pregnant population.

A116

**Re-conceptualizing prenatal life stressors in predicting postpartum depression:  
Cumulative-, specific-, and domain-specific approaches to calculating risk**

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Background: Prenatal life stress predicts postpartum depression (PPD). In general, studies examine individual stressors (specific) or the summation of such exposure (cumulative) and their associations with PPD. Such approaches may oversimplify prenatal life stress as a risk factor for PPD. This study evaluated approaches in assessing prenatal life stress as a predictor of PPD diagnosis, including a domain-specific approach that captures cumulative life stress while accounting for stress across different life stress domains (i.e., financial, relational, physical health). Methods: The Pregnancy Risk Assessment Monitoring System (PRAMS), a population-based survey, was used to analyze the association of prenatal life stressors with PPD diagnoses among 3,566 New York City postpartum women. Results: Specific stressors were not associated with PPD after controlling for sociodemographic variables. Exposure to a greater number of stressors was significantly associated with PPD diagnosis, even after controlling for both sociodemographic variables and specific stressors (OR=3.1, CI=1.5-6.7). Risk increase was observed with fewer total stressors from a domain-specific perspective. Individuals reporting a moderate-to-high number of financial problems along with a moderate-to-high number of physical problems were at greater risk (OR=4.2, CI=1.2-15.3), and those with moderate-to-high number of problems in all three domains were at most risk (OR=5.5, CI=1.1-28.5). Conclusions: In assessing prenatal stress, clinicians should consider the extent to which stressors occur across different life domains, as this appears to be more predictive of PPD diagnosis than simple assessments of individual stressors, which typically overestimate risk or cumulative exposures.

A117

**Ascertainment of gestational age in an administrative database: Using a day-specific algorithm with week-specific data leads to disparate results**

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Several perinatal health indicators require accurate assessment of gestational age (GA). GA is estimated from last menstrual period (LMP) and early ultrasound (EUS) information, and current algorithms presume the presence of day-specific EUS estimates, though these may not be available in all administrative databases. We examined the influence of applying a modified day-specific algorithm to administrative data when EUS was available only in completed weeks on rates of early term elective, repeat cesarean delivery (ERCD) (delivery at 37-38 weeks gestation). Our population was drawn from births in British Columbia, Canada, between 2008 and 2012 (n=175,000) using data from the BC Perinatal Data Registry. We restricted our population to singleton pregnancies delivered by ERCD at term with both LMP and EUS information available. Women with pregnancy complications warranting early delivery were excluded. When GA was based on the modified algorithm, 5,533 women delivered by ERCD at term; of these 3,712 (67.1%, 95% CI 65.8-68.3) delivered at early term. Of 5,607 women who delivered by ERCD at term according to the day-specific algorithm, 2,687 (47.9%, 95% CI 46.6-49.2) delivered at early term. ERCD frequency at early term was significantly higher using the modified algorithm (relative risk 1.40, 95% CI 1.35-1.45, P<0.0001). The value of perinatal databases for studying GA-related indicators depends on whether they collect sufficiently specific data for assessing day-specific GA based on LMP and EUS information. Variations in indicator rates across jurisdictions may be due to variations in populations, practice factors, or differences in collection or assessment of GA.

**Validity of maternal and infant outcomes within Medicaid data**

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The US Medicaid Analytic eXtract (MAX), a nationwide healthcare utilization database, is a useful resource for studies of medications in pregnancy. However, the accuracy of maternal and infant outcomes identified within MAX has not been established. We assessed the validity of computerized claims to detect preeclampsia, congenital cardiac malformations and persistent pulmonary hypertension of the newborn (PPHN). Using 2000-2007 MAX data, we selected a cohort of over 1 million pregnancies. We identified women with ICD-9 diagnostic codes indicative of preeclampsia and infants with codes indicative of cardiac malformations or PPHN. We reviewed hospital medical records for a sample of pregnancies with possible outcomes based on computerized claims, and calculated the positive predictive value (PPV) and 95% confidence intervals (CI) for each outcome. Among the 120 women with inpatient preeclampsia diagnoses, the PPV was 92% (CI: 86-96%). The PPV for cardiac malformations overall was 80% (CI: 69-89%) when >1 inpatient code was required (N=60). Requiring only  $\geq 1$  inpatient code for selected cardiac malformations more than doubled the number of possible cases, but reduced the PPV to 70%. The PPV was 68% (CI: 58-78%) for PPHN when  $\geq 1$  inpatient code was required (N=79). Inpatient preeclampsia identified in MAX had high validity. However, as had been reported for other administrative databases, the validity of claims to identify cardiac malformations and PPHN was fair. Sensitivity analyses or medical record confirmation may be necessary when studying PPHN or birth defects in MAX data.

A119

**Creating valid and reliable retrospective measures of childhood neighborhood context for reproductive health studies**

**Osypuk TL \*, Caldwell CH, Sealy-Jefferson S, Slaughter JC, Straughen JK, Dailey R, Helmkamp L, Misra DP  
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Early life exposures influence numerous social determinants of health, which may be especially important for explaining racial disparities in health outcomes. However few epidemiologic studies have tested whether early life neighborhood context influences later life health, including reproductive outcomes. Within a cohort study of PTB among Black women in Southfield, Michigan (71% response rate) (the Life-course Influences on Fetal Environments Study), we sought to test the validity and reliability of retrospectively reported subjective measures of early life neighborhood context, by comparing survey-based reports from two reporters (recently postpartum adult women and their mothers, n=575). We also compared subjective with objective neighborhood measures derived from administrative data, linked by residential histories. Neighborhood subjective context when women were aged 10 was measured retrospectively by survey report of two multi-item measures: neighborhood social disorder and neighborhood social control. Internal consistency reliability was high for the scales ( $\alpha=.77-.85$ ), yet a woman's and her mother's reports of the same childhood neighborhood were only weakly (significantly) correlated ( $\rho=.23$  and  $.15$ ). Comparison of subjective with objective neighborhood measures (index of neighborhood deprivation derived from interpolated census & ACS data 1970-2009 when women were aged 10) found moderate correlations. Subjective-objective neighborhood associations were 2-3 times stronger with social disorder than with social control for both women and their mothers, with stronger correlations for social disorder and neighborhood deprivation scores (e.g.  $\rho=.40$ ). These results provide evidence that retrospective reports of subjective neighborhood context may be a cost-effective, valid, reliable method to operationalize early life context for health studies.

**Bacterial vaginosis-associated bacteria increase the risk of pelvic inflammatory disease**

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Pittsburgh, PA)

Background: As up to 70% of cases of pelvic inflammatory disease, the frequent infection and inflammation of the upper genital tract that often causes infertility, have an unidentified non-gonococcal, non-chlamydial etiology, we sought to determine the relationship between select vaginal bacteria and PID. Methods: We conducted a pilot case-control study of 20 patients who developed PID and 17 controls who did not, matched by visit date and race, nested within the prospective Gynecologic Infections and Follow-Through (GIFT) study which followed high risk women three years. Species-specific 16S ribosomal rRNA gene quantitative PCR assays were applied to vaginal swabs from visits occurring immediately preceding and within 3 months of PID. Gene copy variables were log transformed and negative samples assigned a value equal to half the lower limit of detection for each bacterium. Analyses were adjusted for age and gonorrhea. Results: Women who tested positive for *Atopobium vaginae*(AV, ORadj 5.8, 95% CI 1.3-26.7) or *Leptotrichia/Sneathia*(ORadj 5.8, 95% CI 1.1-29.1) were significantly more likely to develop PID, with similar trends for bacterial vaginosis associated bacterium 1(BVAB1, ORadj 2.6, 95% CI 0.6-10.7), BVAB2(ORadj 2.9 95% CI 0.7-12.4) and *Megasphaera* phylotype 1, 2(ORadj 23.9, 95% CI 0.9-16.2). Cases had higher median concentrations of bacteria DNA for AV( $2.3E5$  vs.  $5.9E1$ ,  $p\text{-value}_{adj}=0.05$ ), *G. vaginalis*(GV,  $6.1E6$  vs.  $1.3E4$ ,  $p\text{-value}_{adj}=0.08$ ) and *Megasphaera*( $2.7E4$  vs.  $5.9E2$ ,  $p\text{-value}_{adj}=0.08$ ). Conclusions: This is the first study to demonstrate that AV, *Leptotrichia*, BVAB1, BVAB2, and *Megasphaera* are predictive of PID. These intriguing results should be validated in larger, diverse studies.

A121

**Early life emotional, physical and sexual abuse and the development of premenstrual syndrome**

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While previous studies have suggested that violent victimization is common in women with premenstrual syndrome (PMS), the impact of early life abuse on the development of PMS remains unclear. In particular, it is unknown whether associations may be mediated by the high prevalence of PMS risk factors including smoking and obesity among women reporting childhood abuse. We have assessed the relation of early life abuse and the development of moderate-to-severe PMS in a case-control study nested within the prospective Nurses' Health Study II. Participants were aged 27-44 and free from PMS at baseline, including 1018 cases who developed PMS over 14 years (1991-2005) and 2225 comparison women reporting no PMS diagnosis and minimal menstrual symptoms. History of emotional, physical and sexual abuse in childhood and adolescence was self-reported in 2001. After adjustment for obesity, smoking, abuse in adulthood and other factors, emotional abuse was linearly related to PMS risk ( $P < 0.0001$ ); women reporting the highest level of childhood emotional abuse had 2.6 times the risk of PMS as those reporting no emotional abuse (95% confidence interval (CI) = 1.7-3.9). Women reporting severe childhood physical abuse had an odds ratio of 2.1 (95% CI = 1.5-2.9;  $P < 0.0001$ ) compared to those reporting no physical abuse. Sexual abuse was not consistently associated with risk. Additional adjustment for childhood social support had minimal effect on risk estimates. Findings from this large population-based study suggest that early life abuse, especially emotional and physical abuse, are strong risk factors for incident PMS.

**Circulating vitamin D levels and bacterial vaginosis prevalence among nonpregnant women: Does a threshold exist and does it vary by race/ethnicity?****Sapra KJ\*, Randis TM, Whittier S, Gelber SE, Ratner AJ  
(Columbia University Medical Center, Dept of Pediatrics, New York, NY)**

Purpose: Low circulating vitamin D level (LCVDL) is associated with bacterial vaginosis (BV) among pregnant women; however, this relationship has not been established among nonpregnant women. We investigated whether LCVDL is associated with BV in a diverse sample of nonpregnant women and if the threshold for LCVDL-BV relationship differs by race/ethnicity. Methods: Data are from BVIDEAS, a study of BV in an urban GYN clinic (n=434). BV was assessed by Nugent score. 277 women gave blood. Serum 25(OH)D<sub>2</sub>+D<sub>3</sub> was dichotomized into common LCVDL cutoffs: <20ng/ml and <30ng/ml. Women with D<sub>2</sub> <limit of detection (LOD=1.5ng/ml) were assigned values of LOD/2, which were added to their D<sub>3</sub> levels. Prevalence differences (PD) and 95% confidence intervals (CI) were calculated by race/ethnicity, adjusted for smoking and douching. Results: BV prevalence was 52%. With 20ng/ml cutoff, 35% of women had LCVDL; with 30ng/ml cutoff, 74% had LCVDL. With 20ng/ml cutoff, LCVDL was associated with BV among Hispanics (PD:0.21, 95%CI:0.04,0.39) but not blacks (PD:0.04, 95%CI:-0.17,0.25), whites (PD:0.00, 95%CI:-0.51,0.51), or others (PD:0.34, 95%CI:-0.13,0.81). With 30ng/ml cutoff, LCVDL was associated with BV among blacks (PD:0.30, 95%CI:0.02,0.58) but not Hispanics (PD:0.05, 95%CI:-0.14,0.23), whites (PD:-0.06, 95%CI:-0.35,0.23), or others (PD:-0.04, 95%CI:-0.78,0.71). Discussion: Our data suggest LCVDL is associated with BV among nonpregnant women, and the threshold at which LCVDL increases BV prevalence varies by race/ethnicity. Black women may need higher CVDL than Hispanic women to prevent increased BV prevalence. Study limitations include a large percentage of women not giving blood or having D<sub>2</sub> levels < LOD. Further studies are indicated.

A123

**The influence of ART on the treatment of Trichomonas vaginalis among HIV-infected women**

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Objective: Trichomonas vaginalis (TV) is a common sexually transmitted infection (STI) in women and can cause severe inflammation with discharge. In pregnant women TV has been linked to premature membrane rupture, preterm birth, and low birth weight. TV has also been shown to increase vaginal shedding of HIV and, thus, may influence HIV sexual and perinatal transmission. The prevalence and repeat infections of TV among HIV+ women is common. Bacterial vaginosis (BV) has been shown to interfere with metronidazole (MTZ) treatment. The purpose of this study was to examine the influence of antiretroviral therapy (ART) usage on the response to treatment of TV. Methods: A secondary data analysis was performed on a cohort of HIV+/TV+ women who were randomized to single (2gm) dose or 7 day (500mg BID) dose MTZ. Test of cure visit, via culture, occurred 6-12 days after treatment completion. Information was collected on sex partner treatment and sexual exposures. Repeat TV infection rates were compared for women on ART at baseline versus not on ART, controlling for BV and treatment arm. Results: Of the 230 women included, those on ART had higher repeat infections than women not on ART [25/150 (16.7%) vs. 6/80 (6.3%), p-value= 0.03]. Controlling for BV status and stratifying by treatment arm, the association was only found in the single-dose arm (p-value= 0.05) and not in the multi-dose arm (p-value=0.39). Conclusions: ART usage is associated with a higher TV repeat infection rate. This adds to the growing evidence that single-dose MTZ is not an appropriate treatment for HIV+ women with TV.

**Endometrial neutrophil and plasma cell counts among women with clinically suspected pelvic inflammatory disease****Wiringa AE\*, Brooks MM, Ness RB, Taylor BD, Haggerty CL  
(Department of Epidemiology, University of Pittsburgh Graduate School of Public Health,  
Pittsburgh, PA)**

Objective: Clinically diagnosed pelvic inflammatory disease (PID), infection and inflammation of the uterine lining (endometritis) and fallopian tubes (salpingitis), is confirmed by laparoscopically verified salpingitis (the gold standard) or the surrogate endometritis (defined by Kiviat's criteria of  $\geq 5$  neutrophils and  $\geq 1$  plasma cells). Salpingitis has been associated with long-term sequelae including infertility, whereas endometritis has not. As the utility of endometrial histology for predicting sequelae is unclear, we sought to describe the distribution of endometrial neutrophil and plasma cell counts and sequelae among women with mild-to-moderate clinically suspected PID. Methods: Baseline endometrial biopsy samples were available for 624 women from the PID Evaluation and Clinical Health (PEACH) study. We compared endometrial neutrophil and plasma cell counts between women with infertility ( $\geq 12$  months unprotected intercourse without conception), pregnancy (self-reported), or live birth at follow-up (mean = 84 months) and those without using the Wilcoxon rank-sum test. Results: During follow-up 359 (57.5%) women experienced pregnancy, 267 (42.8%) live birth (74.4% of ever-pregnant women), and 104 (16.7%) infertility. Among 189 (30.3%) women with  $\geq 1$  neutrophil there were no significant differences in counts (median [interquartile range]) between women with vs. without pregnancy (20 [30] vs. 20 [40];  $p=0.96$ ), live birth (20 [30] vs. 9 [45];  $p=0.51$ ), or infertility (20 [40] vs. 20 [30];  $p=0.97$ ). Similarly, among 288 (46.2%) women with  $\geq 1$  plasma cell, no significant differences in counts between women with vs. without pregnancy (6.25 [23] vs. 9.04 [27.26];  $p=0.15$ ), live birth (5.69 [23] vs. 4.25 [23.13];  $p=0.87$ ) or infertility (6.15 [27.5] vs. 6.88 [22.87];  $p=0.76$ ) were observed. Conclusions: No significant differences in cell counts were observed between women with sequelae vs. none. Additional analyses are needed to evaluate whether endometrial neutrophil and/or plasma cell counts have utility for the prediction of gynecologic and reproductive outcomes.

## **Recurrence of gestational hypertensive disorders and impact on newborn outcomes**

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Preeclampsia (PE) and gestational hypertension (GH) often recur in subsequent pregnancies. How recurrence and changes in type of hypertensive disorder impact newborn outcomes is not well studied. We examined recurrence of PE, recurrence of GH, GH after PE and PE after GH in a retrospective cohort of 26,963 nulliparous women with their first 2 singleton births in Utah (2002-2010). First, we identified risk factors for recurrence by evaluating prepregnancy body mass index (BMI), interpregnancy interval, smoking, marital status, prior preterm delivery <34 weeks (PTB34) and prior small for gestational age (SGA). Second, we estimated how recurrence impacted neonatal morbidities including SGA, PTB34 and neonatal intensive care unit (NICU) admission. Poisson regression models with robust variance estimators estimated recurrence risks and newborn morbidities. Recurrence of PE, GH, PE after GH and GH after PE, occurred in 11.4%, 13.0%, 11.8% and 5.6% of women, respectively. Being overweight or obese was the most consistent risk factor of recurrence of any of the hypertensive disorders [relative risks (RRs) ranging 1.6-2.2,  $p \leq 0.02$ ]. Additionally, PE recurrence was associated with being non-White [RR=1.8; 95% confidence interval (CI): 1.1, 2.7] and having a prior PTB34 (RR=2.2; 95%CI: 1.4, 3.4). Adjusting for maternal age, race, prepregnancy BMI and smoking, recurrent PE increased the risk of PTB34 (RR=9.7; 95%CI: 4.8, 19.3) and NICU admission (RR=1.2; 95%CI:1.0, 1.4) while PE after GH increased the risk of PTB34 (RR=5.0; 95%CI=1.3, 18.3) and SGA (RR=1.9; 95%CI: 1.0, 3.5). Neither GH after PE nor recurrent GH increased newborn morbidity.

## **Pre-eclampsia and development of breast cancer**

**Kamper-Jorgensen M\*, Pacheco N, Nybo Andersen AM  
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Women with a pregnancy complicated by pre-eclampsia have been reported to be 20-30% less likely to develop breast cancer. We used nationwide Danish register-based data to prospectively follow all women with a registered pregnancy outcome (e.g. live birth, still birth, induced or spontaneous abortion) during 1978- 2010. Women were followed from time of pregnancy outcome until breast cancer diagnosis, death, emigration, or end of follow-up ultimo 2010, whichever occurred first. We evaluated the association between pre-eclampsia and breast cancer based on incidence rate ratios (IRR) with 95% confidence intervals (CI) estimated in Poisson regression models adjusted for attained age, period and pregnancy number. During follow-up 1,228,700 women experienced 3,000,010 pregnancy outcomes, of which 68.5% were live births, 0.3% were still births, 19.9% were induced abortions, and 9.8% were spontaneous abortions. Women were followed for a total of 21,952,838 person-years, during which 38,807 women were diagnosed with pre-eclampsia and 22,735 women developed breast cancer. Overall, women diagnosed with pre-eclampsia were at 19% reduced risk of developing breast cancer (IRR=0.81 [95% CI 0.73-0.89]). Stratifying on offspring sex revealed a significantly reduced risk of breast cancer among pre-eclamptic women giving birth to boys (IRR=0.68 [95% CI 0.58-0.81]), but none so among women giving birth to girls (IRR=0.95 [95% CI 0.82-1.10]). Also the influence of severity and timing of pre-eclampsia diagnosis, and pregnancy outcome on the association between pre-eclampsia and breast cancer will be presented.

**Validity of preeclampsia registration in the Medical Birth Registry of Norway for women participating in the Norwegian Mother and Child Cohort Study, 1999-2010**

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**(Medical Birth Registry of Norway, Norwegian Institute of Public Health, Bergen, Norway and Department of Global Public Health and Primary Care, University of Bergen, Bergen, Norway)**

The Norwegian Mother and Child Cohort study (MoBa) is a valuable database for studying genetic and environmental causes of preeclampsia. Preeclampsia information in MoBa comes from the Medical Birth Registry of Norway (MBRN), so the aim was to study the validity of preeclampsia registration in the MBRN for MoBa women. All MoBa pregnancies with registered preeclampsia (N=4,081) and a random control group without (N=2,000) were selected. Delivery units were invited to provide copies of antenatal charts containing blood pressure and urinary measurements from all antenatal visits during pregnancy, and hospital discharge codes from the delivery stay. Data for 5,340 pregnancies delivered 1999-2010 was received (87% of all eligible). Sensitivity, positive predictive values (PPV) and specificity of MBRN registrations were calculated, using as gold standard hypertension and proteinuria on the antenatal charts and/or hospital discharge codes indicating preeclampsia. The results showed that overall sensitivity was 96.9% (95% confidence interval: 96.3, 97.5), overall PPV 83.9% (82.7, 85.1) and overall specificity 75.6% (73.8, 77.4). Some regional variations were found. Sensitivity and PPV was higher and specificity lower when women were primiparous, or delivered preterm (sensitivity=99.7%, PPV=93.5%, specificity=60.7%) or low birth weight infants (sensitivity=99.4%, PPV=93.8%, specificity=53.7%). Approximately 80% of the false positive cases had evidence of hypertension or proteinuria, although they never fully met the preeclampsia criteria. Severe preeclampsia in the MBRN was found to be a true severe preeclampsia in 70% of cases, but a true preeclampsia in above 90% of cases.

## **Elevated maternal mid-trimester serum inflammatory cytokines among women with preeclampsia**

**Taylor BD\*, Ness RB, Olsen J, Hougaard DM, Skogstrand K, Roberts JM, Haggerty CL (University of Pittsburgh, Pittsburgh, PA)**

Objective: As inflammatory cytokines have been cross-sectionally associated with preeclampsia at delivery, we examined associations between mid-trimester serum cytokines and preeclampsia. Methods: We conducted a nested case-control study of 367 preeclamptic women and 269 normotensive controls with primiparous singleton pregnancies enrolled in the Danish National Birth Cohort between 13-17 weeks gestation. Preeclampsia was defined and graded as: mild preeclampsia (blood pressure  $\geq 140/90$ mmHg and proteinuria  $\geq 3$ g/24h), severe preeclampsia (blood pressure  $\geq 160/110$ mmHg, proteinuria  $\geq 5$ g/24h, or evidence of complications) and preterm preeclampsia (birth  $< 37$  weeks gestation). Logistic regression was used to calculate odds ratios (OR) and 95% confidence intervals (CI) to determine associations between elevated ( $> 75$ th percentile) RANTES, interleukin (IL)-6, IL4, IL5, IL12, IL10, IL18, IL8, IL1-beta, interferon (IFN)-gamma, tumor necrosis factor (TNF)-alpha, and transforming growth factor (TGF)-beta and preeclampsia, adjusting for body mass index, maternal age, and smoking during pregnancy. False discovery rate was used to adjust for multiple comparisons. Results: After adjustment for multiple comparisons, elevated pro-inflammatory IL1-beta (OR 0.3, 95% CI 0.1-0.6) reduced the odds of preterm preeclampsia. Elevated IL1b (OR 0.1, CI 0.03-0.3), pleiotropic cytokine IL6 (OR 2.5, 95% CI 1.4-4.3) and pro-inflammatory IL18 (OR 2.9, 95% CI 1.5-5.8) were significantly associated with mild preeclampsia. Conclusions: Compared to normotensive controls, preeclamptic women have a unique inflammatory profile at mid-trimester which may be involved in pathogenesis or may be a marker for present disease. As cytokine function depends on cell type and overall inflammatory environment, future studies should explore cytokine clusters in preeclampsia risk.

## **Preterm preeclampsia, fetal growth and long-term maternal mortality**

**Skjaerven R\*, deRoo L, Klungsoyr K, Morken N, Haug K, Rich\_Edwards J, Wilcox AJ  
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Women with a preterm birth in a preeclamptic pregnancy have excess cardiovascular (CVD) mortality. Based on complete reproductive experience of 836 147 women, we will evaluate the effects of the size of the fetus in preeclamptic pregnancies and its importance to risk for early death in mothers. We use data from the population-based Medical Birth Registry of Norway, covering 1967-2009. We used women with 1st births 1967 and 2002, and follow them for total reproduction and/or death to 2009. In total there were 23,000 deaths, 3891 were due to cardiovascular (CVD) causes. We used quartiles of birthweight-by-gestational-age to assess size of the fetus. Analyses were adjusted for period, maternal age and education. Women with preterm preeclampsia and a small fetus (lowest quartile), had a 2.5-fold increase (95% C.I 1.6-3.8) in CVD death, while a large fetus (highest quartile), had a 12.3-fold (7.3-21) increased risk. Similarly strong HR-values were found both for 22-34 and 35-36 weeks (HR=11.4, and 13.0). Excluding diabetes only moderately reduced these high risks. For women with only one lifetime pregnancy, all risks were largely increased. No subsequent births may reflect the effects of maternal morbidity, which could decrease fertility or reduce the woman's interest in additional children. Thus, parity may reflect the health of the woman as well as her desired family size. Previous studies show that a woman with a small fetus have higher risk for an early CVD death, however we find that in preterm preeclampsia, a large fetus provide the highest hazard for the mother.

**Randomized clinical trial of preconception low dose aspirin use to improve pregnancy outcomes: EAGeR (Effects of Aspirin in Gestation and Reproduction) trial**

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Low dose aspirin (LDA) initiated post conception has had conflicting results on pregnancy outcomes. This multi-site prospective randomized double-blind placebo-controlled trial sought to determine whether preconception LDA (81 mg/day) treatment improves live birth rates in women with 1-2 prior losses. Women aged 18-40 actively trying to conceive were stratified as: 1) restricted: women with 1 documented loss <20 wks gestational age (GA) during the past year, or 2) general: women with 1-2 prior losses regardless of GA or time since loss. Randomization was stratified by site and restricted/general strata. Participants were treated/followed for  $\leq 6$  menstrual cycles or if they conceived, throughout pregnancy with treatment discontinued at 36 wks GA. An intent-to-treat approach with sensitivity analysis for compliance was used to estimate effects. 1228 women were randomized: 615 LDA and 613 placebo. 1078 (87.8%) women completed the trial. Live birth rates were 57.8% LDA vs. 52.7% placebo ( $p=0.093$ ). In the restricted strata ( $n=492$ ), live birth rate was 62.4% LDA vs. 53.2% placebo ( $p = 0.039$ ), and in the general strata ( $n=586$ ), 53.9% LDA vs. 52.2% placebo ( $p = 0.68$ ). LDA was associated with higher implantation rates in the restricted strata (73.5% clinically confirmed pregnancies vs. 63.4% placebo), but not the general strata (66.0% LDA; 63.2% placebo). Major complications were similar among groups although LDA was associated with increased minor vaginal bleeding not associated with pregnancy loss. Daily LDA initiated preconception was associated with a significant increase in live births among women with a documented loss <20 wks GA during the past year.

## **Low technology assisted reproduction and preterm birth**

**Messerlian C\*, Platt RW, Tan SL, Gagnon R, Basso O  
(McGill University, Montreal, Canada)**

A higher risk of preterm birth has consistently been observed among singleton pregnancies conceived through in vitro fertilization (IVF) and intracytoplasmic sperm injection (ICSI). The evidence regarding treatment that does not involve gamete manipulation, such as intrauterine insemination (IUI) is, however, limited. Low technology treatment could also conceivably be associated with adverse outcomes as even pregnancies occurring naturally after a period of infertility are at increased risk of preterm birth. We present preliminary results from a retrospective hospital-based cohort study of women residing in Montreal, Canada who delivered at the Royal Victoria Hospital from April 2001 to September 2007. We use the McGill University Obstetrical and Neonatal Database. The cohort consisted of 18,179 singleton births; of these, 110 were conceived through IUI or intra-cervical insemination (IUI group), 394 through IVF or ICSI (IVF group), and 17,675 had no indication of being conceived as a result of infertility treatment and served as the reference group. Crude odds ratios of preterm birth ( $\leq 37$  weeks) were 1.99 (95% Confidence Interval (CI): 1.15-3.43) and 1.87 (95% CI: 1.38-2.54) for the IUI and IVF groups, respectively. Adjusting for age, parity, and education did not materially change estimates: 2.00 (95% CI: 1.15-3.48) and 1.80 (95% CI: 1.32-2.45) for the IUI and IVF groups, respectively. The adjusted odds ratios of very preterm birth ( $< 34$  weeks) were 4.36 (95% CI: 2.08-9.13) for the IUI group and 2.08 (95% CI: 1.22-3.53) for the IVF group. These results suggest that women undergoing low technology treatment are also at increased risk of preterm birth. It is possible that the underlying conditions leading to infertility may be involved in the etiology of adverse pregnancy outcomes.

## **The effect of perceived stress on reproductive function**

**\*Schliep KC, Mumford SL, Vladutiu CJ, Ahrens KA, Prasad A, Perkins N, Wactawski-Wende J, Schisterman EF**

**(Eunice Kennedy Shriver National Institute of Child Health and Human Development, Bethesda, MD)**

Stress has been shown to suppress ovulation in animal models, but its effect on human reproduction is unclear. We examined the association between perceived stress, reproductive hormones, and ovulation in a prospective cohort of healthy premenopausal women. BioCycle Study participants (n=259, mean age=27.3 ± 8.2 years) were followed for up to 2 menstrual cycles providing fasting blood specimens at up to 8 visits/cycle corresponding to menstruation, mid- and late- follicular phases, luteinizing hormone (LH) surge, ovulation, and early, mid and late luteal phases. Women recorded daily stress levels [not stressful (1), a little stressful (2), very stressful (3)] from which average phase levels were calculated and categorized into tertiles (low, moderate, high), allowing women to change categories over the cycle. Weighted linear mixed models were used to assess effects of stress on hormone concentrations. Odds ratios (OR) for sporadic anovulation were estimated using generalized linear mixed models. Women with high stress had significantly lower total estradiol (-8.2%; 95% confidence interval (CI): -12.4, -3.7), free estradiol (-9.4%; 95% CI: -13.6, -5.0), progesterone (-6.3%; 95% CI: -12.0, -0.3) and LH concentrations (-11.6; 95% CI: -16.4, -6.6) after adjusting for age, race, depression, adiposity, and daily exercise compared to women with low stress. Women with high stress also had increased odds of anovulation (adjusted OR = 3.6; 95% CI=1.3, 9.8) compared to women with low stress. We found that perceived stress levels were associated with reproductive hormone concentrations and sporadic anovulation, emphasizing the importance of the effects of stress on female reproduction.

## **Large-for-gestational-age birthweight: Does customization improve detection of adverse perinatal outcomes?**

**Sjaarda LA\*, Laughon SK, Mumford SL, Hinkle SN, Mendola P, Albert PS  
(Eunice Kennedy Shriver National Institute of Child Health and Human Development,  
Bethesda, MD)**

Customized definitions of large-for-gestational-age (LGA) birthweight may improve prediction of morbidity, but previous studies have important limitations. In a U.S. obstetrical cohort of 110,447 singleton pregnancies  $\geq 37$  weeks without congenital anomalies, we determined customized LGA ( $>90$ th-percentile) for each pregnancy using coefficients for maternal height, weight, race, parity, neonatal sex and gestational age derived from a multivariable, predictive model of birthweight. Pathophysiologic indicators (e.g. smoking, diabetes, preeclampsia) were also included. There were 6,039 classified as LGA by both methods (LGA-both); an additional 3,384 LGA by the conventional population-based reference only (LGA-pop) and 1,781 LGA captured by the customized reference only (LGA-custom). Compared to LGA-pop, LGA-custom included more non-white (66.9 vs. 28.6%), nulliparous (60.8 vs. 26.3%), younger ( $26 \pm 0.2$  vs.  $29 \pm 0.1$  years) women with lower body mass index ( $23 \pm 0.1$  vs.  $28 \pm 0.1$  kg/m<sup>2</sup>) and more female (72.8 vs. 21.2%) infants ( $P < 0.001$  for all). While morbidity prevalences tended to be highest among LGA-both (8.4% respiratory complications, 10.1% NICU-admission, 17.4% jaundice and 2.1% hypoglycemia), prevalences exclusively classified by LGA-custom compared to exclusively LGA-pop were similar for respiratory complications (6.5% vs. 6.6%,  $P = 0.92$ ) and NICU-admission (7.1% vs. 6.4%,  $P = 0.29$ ), whereas jaundice (14.9% vs. 17.5%,  $P = 0.02$ ) and hypoglycemia (0.95% vs. 1.57%,  $P = 0.07$ ) were less frequent in LGA-custom. Furthermore, perinatal death was similar ( $P = 0.97$ ) in LGA-custom ( $n = 1$ , 0.06%) as LGA-pop ( $n = 2$ , 0.06%), while the majority of mortality occurred within LGA-both ( $n = 12$ , 0.20%). Customized LGA detected a different additional subset of offspring, but with no improvement in detection of morbidity and mortality compared to those detected by the population reference.

## **The NICHD Consecutive Pregnancy Study: Risk factors for recurrent preterm birth**

**Laughon SK\*, Mendola P, Leishear K, Albert PS  
(Eunice Kennedy Shriver National Institute of Child Health and Human Development,  
Bethesda MD)**

Preterm birth (PTB) recurs in approximately 30 percent of subsequent deliveries but our understanding of factors that predict recurrence remains limited. In a retrospective cohort of two consecutive pregnancies among 51,086 women in Utah (2002-2010), binary relative risk regression was performed to examine risk of PTB < 37 weeks in the second delivery adjusting for maternal age, race/ethnicity, prepregnancy body mass index (BMI) category, insurance, smoking, alcohol and/or drug use, and chronic disease. Cumulative incidence curves were created by prior delivery timing (20 to <24, 24 to <28, 28 to <34, 34 to <37, and  $\geq$ 37 weeks). There were 3,836 (7.6%) women that delivered preterm in the first pregnancy, of which 1,160 (30.7%) repeated in the second. Prior history of PTB < 37 weeks was the strongest risk factor for recurrent PTB: adjusted relative risk (RR) 5.01 (95% confidence interval (CI) 4.71-5.33) compared to women with prior term birth ( $\geq$ 37 weeks). The second delivery cumulative incidence curve was ordered by prior delivery gestational age category until 28 weeks after which the degree of preterm was not as influential as any history of PTB. Controlling for prior PTB, increased risk of recurrence was observed for Hispanic race/ethnicity RR 1.11 (95%CI 1.01-1.22), underweight (BMI <18.5 kg/m<sup>2</sup>) RR 1.49 (95%CI 1.34-1.65), public insurance RR 1.07 (95%CI 1.003-1.15), risky behavior such as smoking, drug and/or alcohol use RR 1.62 (95%CI 1.47-1.78) and chronic disease RR 1.38 (95%CI 1.30-1.47). While history of PTB is key, there are potentially modifiable factors that also influence recurrence risk.

## Sugar-sweetened beverage consumption and age at menarche

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*Background* Sugar-sweetened beverage consumption is associated with metabolic changes that could potentially impact menarcheal timing. We investigated whether consumption of sugar-sweetened beverages predicts age at menarche.

*Methods* We analyzed data from 5,584 girls who were premenarcheal and aged 9-14 years in 1996 when they joined the Growing Up Today Study, a prospective cohort study of children of Nurses Health Study II participants. Between 1996-2001, 94% of girls reported their age at menarche (N=5,228) and 4% (N=197) were censored; 3% (N=159) remained premenarcheal at the end of follow-up. Cumulative updated sugar-sweetened beverage consumption (comprised of non-carbonated fruit drink, nondiet soda, and iced tea) was calculated using annual Youth/Adolescent Food Frequency Questionnaires from 1996-1998.

*Results* We observed 5,228 events of menarche during 10,556 person-years. In multivariable models, girls consuming >1.5 sugar-sweetened beverages daily had an estimated 2.7-month earlier menarche relative to those consuming ≤2 sugar-sweetened beverages weekly. Correspondingly, premenarcheal girls who reported consuming >1.5 servings of sugar-sweetened beverages per day were, on average, 24% more likely [95% confidence interval: 13%, 36%; p-trend: <0.0001] to attain menarche in the next month relative to girls who reported consuming ≤2 servings of sugar-sweetened beverages weekly. Frequency of non-carbonated fruit beverage and nondiet soda consumption, but not iced tea, diet soda, or fruit juice consumption predicted earlier menarche.

*Conclusions* More frequent sugar-sweetened beverage consumption may predict earlier menarche in girls, a risk factor for adverse health outcomes including breast cancer. Our findings provide further support for public health efforts to reduce sugar-sweetened beverage consumption.

**Investigating the impact of folic-acid supplement use on the relationship between exposure to PM<sub>2.5</sub> during early pregnancy and congenital heart defects****Stingone JA\*, Luben TJ, Daniels JL, Fuentes M, Richardson DB, Herring AH, Carmichael SL, Aylsworth AS, Anderka M, Botto L, Correa A, Gilboa SM, Langlois PH, Lupo PJ, Mosley B, Shaw GM, Siffel C, Olshan AF and the National Birth Defects Prevention Study (University of North Carolina, Chapel Hill, NC)**

With increasing evidence that air pollution exposure is associated with decreased DNA methylation and that maternal DNA methylation status is associated with congenital heart defects (CHDs), we explored the hypothesis that mechanisms related to altered DNA methylation underlie the association between air pollution and CHDs. Folate, a methyl donor, is necessary to initiate and regulate DNA methylation processes. We utilized the National Birth Defects Prevention Study, a case-control study with data on residential history, diet and supplement use during pregnancy, to investigate whether use of folic-acid supplements modifies the relationship between maternal exposure to fine particulate matter (PM<sub>2.5</sub>) and CHDs. Weekly average PM<sub>2.5</sub> concentrations were assigned to 7715 mothers of cases and controls using the closest stationary monitor during weeks two through eight of pregnancy. Effect measure modification was assessed using likelihood ratio tests comparing logistic regression models, adjusted for maternal demographics, smoking and alcohol use, with and without interaction terms between PM<sub>2.5</sub> exposure and supplement use. We observed folic-acid intake, defined dichotomously by supplement use or as a multilevel variable which incorporated supplement use and dietary folate intake, reduced the strength of the association between PM<sub>2.5</sub> and individual CHDs. For example, comparing women at the highest versus lowest decile of PM<sub>2.5</sub> exposure, the odds ratio (OR) for coarctation of the aorta was elevated only among women who did not take folic-acid supplements (OR 5.71, 95% confidence interval 1.24, 26.2 versus OR 0.75, 95% CI 0.33, 1.69). Our findings suggest folic-acid may reduce the risk of CHDs associated with PM<sub>2.5</sub> exposure during early pregnancy.

## B2

### **Association between maternal intake of vitamin E and birth defects, National Birth Defects Prevention Study, 1997-2005**

**Gilboa SM\*, Lee KA, Cogswell ME, Traven FK, Botto LD, Riehle-Colarusso T, Correa A, Boyle CA, and the National Birth Defects Prevention Study (Centers for Disease Control and Prevention, Atlanta, GA)**

In a recent study, high maternal periconceptional intake of vitamin E from foods and supplements was associated with congenital heart defects. We used data from 4,525 controls and 8,665 cases from the National Birth Defects Prevention Study to investigate the association between periconceptional intake of vitamin E from foods and supplements and selected major birth defects. We categorized total vitamin E intake into quartiles (referent, lowest quartile). We estimated associations using multiple logistic regression adjusting for demographic, lifestyle and nutritional factors. In primary analyses, we observed no association between vitamin E intake and risk for any subtype of congenital heart defect. We observed decreased odds for cleft lip with or without cleft palate (quartile 2: OR 0.77; 95% CI 0.63 - 0.95) and increased odds for hypospadias (quartile 3: OR 1.34; 95% CI 1.02 - 1.75; quartile 4: OR 1.38; 95% CI 1.06 - 1.80). In secondary analyses adjusting for total energy intake, one association with hypospadias remained (fourth quartile only) and associations were observed with left ventricular outflow tract obstruction (LVOTO) defects (quartile 3: OR 1.47; 95% CI 1.10 - 1.95), coarctation of the aorta (a LVOTO subtype) (quartile 3: OR 1.70; 95% CI 1.06 - 2.74), small intestinal atresia/stenosis (quartile 3: OR 1.84; 95% CI 1.02 - 3.32) and anorectal atresia/stenosis (quartile 3: OR 1.78; 95% CI 1.08 - 2.94). There is limited evidence of an association between vitamin E intake and birth defects. Observed associations were not consistent with exposure-response relationships and should be interpreted in light of the large number of comparisons made.

**Blood mercury levels in pregnant and non-pregnant women in the United States (NHANES 1999-2010)****H Razzaghi<sup>\*,1,2</sup>, Tinker SC<sup>1</sup>, Crider K<sup>1</sup>****(<sup>1</sup>National Center on Birth Defects and Developmental Disabilities, Centers for Disease Control and Prevention (CDC), Atlanta, GA; <sup>2</sup>Oak Ridge Institute for Science and Education, Oak Ridge, Tennessee)**

Background: Prenatal exposure to methyl mercury is associated with adverse neurological development in children. We examined total blood mercury (BHg) levels and predictors of higher BHg levels in pregnant and non-pregnant women. Methods: Data from 1,183 pregnant women aged 16-49 years from the 1999-2006 National Health and Nutrition Examination Survey (NHANES), and 7,844 non-pregnant women aged 16-49 years from the 1999-2010 NHANES were analyzed. We estimated geometric mean BHg levels, as well as characteristics associated with higher mercury levels ( $\geq 3.5$   $\mu\text{g/L}$ ) in crude and adjusted models. Results: After adjusting for age (16-25, 26-35, and 36-49) and race/ethnicity (non-Hispanic white, non-Hispanic black, Mexican American, and other/multiracial), geometric mean BHg levels were similar for pregnant women (0.81  $\mu\text{g/L}$ , 95% confidence interval [CI]: 0.71, 0.91) and non-pregnant women of childbearing age (0.92  $\mu\text{g/L}$ , 95% CI: 0.82, 1.03). Characteristics associated with higher mercury levels were similar for pregnant and non-pregnant women: older age (35+ years), higher education, and higher poverty income ratio. The most significant predictor of high BHg levels for both groups was any seafood consumption in the last 30 days (Odds ratio [OR]: 20.2, 95% CI: 5.29, 77.2; OR: 17.3, 95% CI: 8.98, 33.5, respectively). Conclusion: Pregnancy status does not appear to be strongly associated with BHg levels in women of childbearing age; among both groups seafood consumption is the strongest predictor of high BHg.

**Spatial analysis of gastroschisis in Texas and Massachusetts****Yazdy MM\*, Vieira VM, Langlois PH, Anderka M, Werler MM  
(Slone Epidemiology Center at Boston University, Boston, MA)**

Gastroschisis is a congenital malformation where loops of bowel are protruding from the abdominal wall. Previous research has suggested that gastroschisis cases can occur in clusters. The objective of this study was to identify clusters of gastroschisis in space or the combination of space and time. Cases of gastroschisis were identified from the birth defect registries in Massachusetts and Texas. In each state, a random sample of live-births was selected as controls. Generalized additive models (GAMs) were used to create a continuous map surface of odds ratios (OR) by smoothing over latitude and longitude. Using data from birth certificates, insurance status (MA only), maternal age, race/ethnicity, years of education, and cigarette smoking were assessed for adjustment. Permutation tests were used to assess the significance of location and identify locations with statistically significant increased or decreased ORs. In Massachusetts a statistically significant area of increased risk (OR=2.4) was identified in the north-central part of the state. After adjustment for maternal age and race/ethnicity, the OR decreased to 1.3 and was no longer statistically significant. In Texas, two statistically significant areas of increased risk (ORs=1.6) were identified and remained significant after adjustment for maternal age and race/ethnicity, though the ORs were attenuated to 1.3 in these areas. Texas had sufficient data to assess the combination of space and time, which identified an increased risk (OR=2.9) in the center of Texas in 2003. Exploration of possible artifactual, environmental, or behavioral factors in these areas may further our understanding of the etiology of gastroschisis.

**Use of specific antidepressants and the risk of major cardiac defects: A national cohort study in publicly-insured women****Huybrechts KF\*, Palmsten K, Mogun H, Kowal MK, Setoguchi-Iwata S, Hernandez-Diaz S (Brigham and Women's Hospital, Harvard Medical School, Boston, MA)**

Controversy remains regarding the potential teratogenicity of selective serotonin reuptake inhibitors (SSRIs). The main limitations of previous studies were insufficient sample size to assess specific SSRIs and specific malformations, and potential confounding by indication. We addressed these limitations using a large cohort of women with clinically diagnosed depression. The source population included 935,040 Medicaid-eligible women during 2000-2007. We examined the risk of major cardiac defects overall, and right ventricular outflow obstruction (RVOO) and ventricular septal defects (VSD) in particular, associated with first trimester SSRI use. Claims-based outcomes were validated through medical record review, with positive predictive values between 75-85%. We restricted the cohort to women with depression and used propensity scores to further adjust for depression severity and other potential confounders. During the first trimester, 46,792 (5.0%) women received SSRIs. The prevalence of cardiac malformations was 1.65% among users and 1.28% among non-users. Associations for any cardiac defect were attenuated with increasing levels of covariate adjustment. For SSRIs overall, relative risks were 1.29 (95% confidence interval, 1.20-1.39) unadjusted, 1.18 (1.08-1.29) depression-restricted, and 1.10 (1.00-1.22) fully-adjusted. For paroxetine, sertraline and fluoxetine, fully-adjusted relative risks were 0.99 (0.82-1.20), 1.11 (0.95-1.31), and 1.13 (0.95-1.35). No increased risk was observed for previously hypothesized associations between paroxetine and RVOO (0.82, 0.49-1.36), or sertraline and VSD (1.02, 0.75-1.37). Results did not change using the estimated positive predicted values in sensitivity analyses. After careful control for depression severity and using a very large cohort, no increased risk of specific cardiac defects was observed for commonly used SSRIs.

**Hypospadias and genes related to genital tubercle and early urethral development****Carmichael SL\*, Ma C, Choudhry S, Lammer EJ, Witte JS, Shaw GM  
(Stanford University, Stanford, CA)**

Hypospadias, one of the most common structural birth defects, occurs when the urethral opening is on the underside of the penis. We examined whether variants in genes associated with genital tubercle (the anlage for the penis) and early urethral development were associated with hypospadias in humans. We examined 293 relatively common tagSNPs in BMP4, BMP7, FGF8, FGF10, FGFR2, HOXA13, HOXD13, HOXA4, HOXB6, SRY and SOX9, WT1, WTAP, SHH, GLI1, GLI2, and GLI3 among 624 cases (81 mild, 319 moderate, 209 severe, 15 undetermined severity) and 844 population-based non-malformed controls born in California from 1990-2003. There were 28 SNPs for which any of the comparisons (i.e., overall or for a specific severity) had a p-value <0.01. The homozygous variant genotypes for 4 SNPs in BMP7 were associated with at least 2-fold increased risk of hypospadias, regardless of severity. Five SNPs for FGF10 were associated with 3- to 4-fold increased risks, regardless of severity; for four of them, results were restricted to whites. For GLI1, GLI2 and GLI3, there were 12 associated SNPs but results were inconsistent by severity and race-ethnicity. For SHH, one SNP was associated with 2.4-fold increased risk of moderate hypospadias. For WT1, six SNPs were associated with approximately 2-fold increased risks, primarily for severe hypospadias. In conclusion, this study suggests that SNPs in several genes that contribute to genital tubercle and early urethral development are associated with hypospadias risk.

**The timing and tempo of puberty, estrogens, and westernization: A migrant study of Bangladeshi girls to the UK****Houghton LC\*, Bentley GR, Booth M, Troisi R, Hoover RN, Ziegler RG, Katki HA (Epidemiology and Biostatistics Program, Division of cancer Epidemiology and Genetics, National cancer Institute, Rockville MD)**

Background: When Asian women migrate to the West, particularly as children, their risk for breast cancer increases substantially. Early life stages including adrenarche (onset of androgen production), thelarche (onset of breast development) and menarche (first menstrual period), are perceived as susceptible periods. Hormonal factors, such as elevated estrogens, are also hypothesized to explain increased breast cancer risk. We investigate these hypotheses by comparing the timing of pubertal development and childhood levels of estrogens among girls living in two countries with different breast cancer risks. Methods: We investigated patterns of pubertal development in a cross-sectional study of Bangladeshi (n=192), Migrant (n=206) and British (n=50) girls, aged 5-16 years. Interviews obtained anthropometrics and pubertal staging. Urinary estrogen and estrogen metabolites (EM) were analyzed using liquid chromatography-mass spectrometry. Median ages for each pubertal stage were estimated from parametric survival analyses using Weibull regression models. Group differences in anthropometrics and EM were tested using age-adjusted linear regression. Results: All anthropometrics increased with increasing Westernization. While the ages at adrenarche and menarche did not differ across the groups, the median age at thelarche decreased with Westernization (Bangladeshi=10.7, Migrant=9.4, British=8.7 p-trend<0.0001). There is no evidence that age-specific EM levels differed among groups. Conclusion: Breasts developed earlier among girls living in the UK when compared to Bangladeshi girls. The tempo between early life stages may contribute to international differences in breast cancer risk. Future studies exploring hormonal risk factors should focus their efforts on the window between adrenarche and menarche, which includes the period of breast development.

**B8**

**The developmental origins of chronic inflammation in young adults: Findings from a U.S. national cohort**

**deRosset LA\*, Strutz KL, Hussey JM, Richardson LJ, Whitsel EA  
(University of North Carolina, Chapel Hill, NC)**

Chronic inflammation is associated with leading causes of adult morbidity and mortality, including cardiovascular disease. While contemporaneous predictors of inflammation have been well documented, much less is known about the potential contributions of earlier exposures. This study addresses this gap by examining the developmental origins of chronic inflammation in young adults. Drawing on more than 12,000 observations in the National Longitudinal Study of Adolescent Health (Add Health), we will first characterize the association between birth weight (grams) and high sensitivity C-reactive protein (hsCRP) concentration levels in young adults. Second, using regression analyses, we will evaluate hypothesized social, behavioral, and biological pathways linking birth weight to young adult inflammation. Potential effect modification by sex and race/ethnicity also will be assessed. As one of the first studies to examine the association between birth weight and hsCRP concentrations in a large, diverse and nationally representative U.S. cohort, our findings will provide new evidence on the developmental origins of inflammation and adult chronic disease risk.

## **B9**

### **Environmental tobacco smoke exposure in the homes of Canadian children**

**Slogrove AL\*, Bettinger JA**

**(Department of Pediatrics, University of British Columbia, Vancouver, Canada)**

Background: Young children living with a smoker experience greater environmental tobacco smoke (ETS) exposure than children not living with a smoker. Children exposed to ETS have higher rates of sudden infant death syndrome and respiratory disease. Given these risks it was hypothesized that Canadian homes with young children would be less likely than homes without young children to be smoking homes. Methods: Cross-sectional analysis using the Canadian Community Health Survey 2009-2010 to determine the association between childless homes (no child <12 years), older child homes (all children 6-11 years) and younger child homes (at least one child <6 years) with the presence of a smoker in the home. Multivariable logistic regression was used, adjusting for racial origin, income and education. Results: The final analytic sample included 66631 households. Twenty five percent of childless homes were smoking homes compared to 22% of older child homes and 21% of younger child homes. The odds of having a smoking home were no different for older child homes (OR=1.02 [95%CI 0.95,1.10]) and marginally increased for childless homes (OR=1.21 [95%CI 1.15,1.28]) relative to younger child homes. Adjusting for socioeconomic factors did not alter the relationship for older child homes and attenuated it for childless homes (aOR=1.13 [95%CI 1.07,1.19]). Conclusion: Irrespective of socioeconomic differences, homes with young children are as likely as homes with only older children and marginally less likely than childless homes to be smoking homes. This has implications for educational messaging with regards to home ETS exposure in children across the socioeconomic spectrum.

**B10**

**Low docosahexaenoic acid (DHA) intake and significant maternal DHA depletion in the 3rd trimester of pregnancy**

**Zhao JP\*, Levy E, Shatenstein B, Julien P, Nuyt AM, Xiao L, Spahis S, Montoudis A, Fraser WD, Luo ZC**  
**(CHU Sainte-Justine, University of Montreal, Montreal, Canada)**

Docosahexaenoic acid (DHA) is important for fetal brain growth and development. The 3rd trimester of pregnancy is a period of rapid fetal brain growth, but relatively little data are available on the alterations in maternal DHA levels during this period. Fetus depends on mother for DHA that is obtained from diet or endogenously converted from  $\alpha$ -linolenic acid. The conversion rate is up-regulated by pregnancy, but may be down-regulated by conditions such as gestational diabetes and high level of linoleic acid (LA,  $\geq 3.0\%$  of energy) in the diet. In a singleton pregnancy cohort (n=307) study in Montreal, Canada, we investigated the changes in maternal plasma fatty acids concentrations between 24-28 weeks and 32-35 weeks gestation, and the effects of food intakes based on a food frequency questionnaire. The median intake of DHA was  $\sim 100$  mg/day. More than 90% of women had DHA intake below the recommended intake of 300 mg/day. Plasma DHA levels decreased by more than 10% from 24-28 weeks (mean-SD: 1.9-0.5 %) to 32-35 weeks (1.7-0.5 %) gestation ( $P < 0.0001$ ). Dietary intake of DHA at 24-28 weeks was positively correlated with plasma DHA levels at 24-28 and 32-35 weeks ( $r \geq 0.38$ ,  $P < 0.0001$ ). The mean intake of LA was high (11.3-4.3 g/day,  $\sim 5.0\%$  of energy). The results suggest that maternal DHA depletion is significant in the 3rd trimester of pregnancy. Low and inadequate DHA, high LA intake is extremely prevalent in this study population. DHA supplementation and decreased intake of LA-riched foods in pregnancy should be advocated to promote healthy fetal development.

## **B11**

### **Early childhood obesity and child behavior**

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The childhood obesity epidemic raises concerns about the impact of obesity on child behavior. Data from the Follow-Up Development and Growth Experiences Study were used to assess the relationship between obesity and behavior in 423 preschool-aged children (4.5 years). These children were born at two Atlanta hospitals and had participated, as neonates, in a study of risk factors for small-for-gestational-age. Overweight/obesity (using body mass index (BMI), triceps- and subscapular-skinfold-thickness (TST, SST)) was defined as the top 15th percentile of CDC norms. Two measures of behavior were available: the socialization subscale of the Vineland Adaptive Behavior Scale (VABS, mean=100, standard deviation (std)=15) and the Child Behavior Checklist (CBCL, mean=50, std=10, higher scores indicate more problematic behavior). Linear regression was used to estimate the change in behavior score in overweight/obese children relative to children not overweight/obese. Skinfold measures identified too few girls as obese to permit analysis; analyses using skinfold measures were limited to boys. After adjustment, high BMI was not significantly associated with poorer socialization scores on the VABS (-1.32, 95% confidence interval -5.83, 3.18). The association was somewhat stronger (-3.49 (-10.33, 3.34)), but still non-significant, among boys only. Using skinfold measures did not change the conclusion. After adjusting for confounding, there was a suggestion that high BMI might affect CBCL total behavior score among girls (3.39 (-0.09, 6.89)), but no association was observed between any obesity metric and total behavior among boys. These data do not support the supposition that obesity negatively impacts behavior in early childhood.

**B12**

**Sexual maturation in perinatally HIV-infected and HIV-exposed youth in the era of combination antiretroviral treatment**

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Background: Perinatally HIV-infected (PHIV) children have historically demonstrated deficient growth and pubertal delays. However, current combination antiretroviral treatment (cART) regimens may help normalize timing of sexual maturation. Methods: We assessed sexual maturation in two large US longitudinal cohort studies conducted 2000-2012. PHIV and HIV-exposed uninfected (HEU) youth had annual Tanner stage assessments. We compared age at sexual maturity (stage 5 for breast (B5) in girls and genitalia (G5) in boys) between PHIV and HEU youth using interval-censored models, adjusting for race/ethnicity and birth cohort. Race/ethnicity-adjusted models were used to evaluate early cART initiation (<5 yrs) vs later or no cART. In girls, self-reported age at menarche was compared by HIV status using adjusted Cox regression models. Results: The 2469 PHIV youth attained sexual maturity significantly later than the 490 HEU youth, with mean ages of 15.4 vs 14.8 yrs at B5 for girls ( $p=0.02$ ) and 15.9 vs 15.0 yrs at G5 for boys ( $p<0.001$ ). After adjustment, mean delays were attenuated to 4.30 [95% confidence interval (CI):-1.81,10.40,  $p=0.17$ ] and 7.74 [95% CI:1.51,13.98,  $p=0.015$ ] months. Age at menarche was significantly later among PHIV than HEU girls (median=12.5 vs 11.9 yrs, hazard ratio=0.66 [95%CI:0.48,0.92],  $p=0.013$ ). Among PHIV, lack of early cART was associated with adjusted delays of 3.81 [95%CI:-0.99,8.62,  $p=0.12$ ] and 5.14 [95%CI:0.64,9.65,  $p=0.025$ ] months in B5 and G5, respectively. Conclusions: Sexual maturity and menarche occur later in PHIV than in HEU youth. Early initiation of cART in perinatally infected children, as currently recommended, may result in more normal timing of sexual maturation.

**Health related behaviours among mothers of preschool children****Sabr Y<sup>1,2,3</sup> \*, Lisonkova S<sup>1</sup>, Joseph KS<sup>1,3</sup>****(<sup>1</sup>Department of Obstetrics and Gynaecology, University of British Columbia, Vancouver, BC, Canada; <sup>2</sup>Department of Obstetrics and Gynaecology, College of Medicine, King Saud University, Riyadh, Saudi Arabia; <sup>3</sup>School of Population and Public Health, University of British Columbia, Vancouver, BC, Canada)**

Objective: To examine the effect of younger versus older children in the family (ages <6 vs. 6-11 years) on the mother's physical activity, and smoking status. Methods: We studied all women who participated in the Canadian Community Health Survey (CCHS), 2009-2010, were 18-59 years old and had at least one child aged <11 years. The CCHS is a multi-stage health survey involving 124,188 respondents who form a representative sample of the Canadian population. Mothers with at least one child aged <6 years were contrasted with mothers with at least one child aged 6-11 years but no younger children. The association with low physical activity (<15 minutes/day), and smoking (occasional or regular vs. none) was quantified using odds ratios (OR) and 95% confidence intervals (CI). Logistic regression was used to adjust for maternal age, marital status, education, household size, income, and employment status. Results: Among 11,380 women in the study, 65.4% had younger children, 63.1% had low physical activity and 23.7% smoked. The odds of low physical activity were 1.25 times greater among mothers of younger vs. older children (adjusted OR = 1.25, 95% CI 1.15-1.37). In contrast, the odds of smoking were lower among mothers of younger children, as compared with those who had older children (adjusted OR = 0.77, 95% CI 0.69-0.86). Conclusions: Mothers of young children were less likely to smoke; however, they were more likely to be less physical active. Support and effective strategies are required to help mothers with young children increase their physical activity.

**B14**

**Comparing youth and maternal reports on behavioral problems: Predictors of discrepancies and implications for risky behaviors**

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Prior research suggests imperfect agreement between maternal and youth reports of behavioral problems. Predictors of discrepancies are inconsistent, and evidence regarding utility of reported behavioral problems in predicting risky behaviors remains limited. We assessed concordance between maternal and youth reports on the Behavioral Problems Index (BPI) and maternal mental health, maternal age, maternal education, race/ethnicity, and sex of the youth predicted discrepancies. We tested whether elevated BPI predict risky behaviors. For 589 mother-child dyads in the Infant Health Development Program with available data, linear and multinomial logistic regression models were constructed to examine factors predicting discrepancies and to quantify the association between elevated BPI and risky behaviors. Risk scores were previously developed using selected questions from the Youth Risk Behavior Surveillance System (YRBSS). The intraclass correlation assessing agreement was 0.38. Poor maternal mental health and male sex of the youth were associated with larger mother-youth discrepancies (worse maternal rating) ( $p < 0.01$ ) while maternal age, education, and race/ethnicity were not significant predictors. Comparing pairs in which neither mother nor youth reported elevated BPI scores, the YRBSS score was 3.07 points higher when both reported elevated scores; 1.92 if BPI was elevated for the youth, and 0.059 for pairs where BPI was elevated only by maternal report. The pattern was similar when investigating specific subdomains of risk: conduct problems, sexual behavior, suicide/hopelessness, cigarette use, alcohol use, and marijuana use. Youth's reports of behavior problems are more predictive of their risky behaviors than mother's reports, but using both provide more information than either alone.

**B15**

**Impact of universal postnatal home visits on infant hospital admissions in the first year**

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**Aim:** To examine whether the introduction of Universal Health Home Visits (UHHVs) in the first two weeks after birth was associated with a reduction in hospital admissions in the first year of life by facilitating increased contact with community health services. **Methods:** Population based study of 795,855 liveborn infants with linked birth and hospital admission records in NSW from 2001-2009. Annual rate of infants admitted to hospital in the first year per 100 infants born were calculated. To examine whether changes in maternal and infant risk factors and the introduction of UHHVs could explain changes in infant admission rate, a predictive model was developed, using logistic regression and data from 2001 and 2002, and applied to subsequent years data to predict number of infants admitted. **Results:** The infant hospital admission rate decreased by 12.4% from 20.1 admissions per 100 births in 2001 to 17.6 in 2009. Changes in the frequency of maternal and infant risk factors explained 40% of this decrease and the introduction of UHHVs explained 56%. Infants living in an area where UHHVs were offered were less likely to be admitted to hospital in the first year than infants not living in an area with UHHVs (adjusted odds ratio 0.87, 95% confidence intervals 0.85-0.90) **Conclusions:** Over half of the observed decrease in infant hospital admissions can be explained by the introduction of UHHVs, supporting the hypothesis that home visits facilitate contact between families and community health services, increasing access to preventative health care and reducing infant hospital admissions.

**Cesarean section and risk of severe asthma and atopic dermatitis****Trønnes H\*<sup>a</sup>, Wilcox AJ<sup>b</sup>, Lie RT<sup>a,c</sup>, Markestad T<sup>d</sup>, Moster D<sup>a,c,e</sup>****(<sup>a</sup>Department of Global Public Health and Primary Care, University of Bergen, Bergen, Norway; <sup>b</sup>Epidemiology Branch, National Institute of Environmental Health Sciences, National Institutes of Health, Durham, North Carolina; <sup>c</sup>Medical Birth Registry of Norway, Norwegian Institute of Public Health, Bergen, Norway; <sup>d</sup>Department of Clinical Medicine, University of Bergen, Bergen, Norway; <sup>e</sup>Department of Pediatrics, Haukeland University Hospital, Bergen, Norway)**

While the association between cesarean section and asthma is established, the few reports on cesarean section and atopic dermatitis are inconclusive. Our objective was to assess risk of asthma and atopic dermatitis in children delivered by cesarean section. We conducted a national cohort study with prospectively collected data. Every Norwegian citizen is assigned a personal identification number, which was used to link the Medical Birth Registry in Norway to other national registries. We were able to follow all live births in Norway from 1967 through 2001 through 2005. The cases of asthma and atopic dermatitis were identified in the National Insurance Scheme. Only cases with severe disease were registered in this database. A total of 1,760,082 children were included, and we identified 9,349 cases (0.5%) with asthma and 6,930 cases (0.4%) with atopic dermatitis. The overall prevalence of cesarean section was 8.5 %, but the prevalence increased throughout the study period (1967-1978: 3.2%, 1979-1990: 10.4% and 1991-2001: 12.7%). Cesarean section was associated with development of asthma (RR 1.95 (95% CI, 1.85-2.06)) and atopic dermatitis (RR 1.28 (95% CI, 1.19-1.38)) in offspring. These associations were still significant (RR for asthma 1.43 (95% CI, 1.34-1.52) and RR for atopic dermatitis 1.13 (95% CI, 1.04-1.22) after adjustments for pregnancy complications, parity, maternal atopy, year of birth, and socio-demographic factors. In conclusion, cesarean section was associated with increased risk of severe asthma and atopic dermatitis. These associations may have been biased by residual confounding.

**Hospital resource use for U.S. pediatric discharges with critical congenital heart defects:  
An analysis of the 2009 Kids' Inpatient Database (KID)****Simeone RM\*, Oster M, Cassell CH, Armour B, Gray DT, Honein MA  
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Control and Prevention)**

Added to the U.S. Recommended Uniform Screening Panel in 2011, newborn screening for critical congenital heart defects (CCHDs), defined as congenital heart defects (CHDs) requiring surgical or catheter intervention by one year of age, should reduce late diagnoses and might reduce hospital use. We evaluated hospital use among pediatric ( $\leq 20$  years old) discharges with CCHDs compared to those with non-critical CHDs, using data from the Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project 2009 KID to generate nationwide estimates of pediatric discharges and their hospital use. We included discharges with a principal or secondary ICD-9-CM code indicating at least one CHD, excluding discharges with chromosomal or other congenital anomalies or missing age, charges, length of stay (LOS), or cost-to-charge ratios. After exclusions and application of sample weights, there were 88,069 CHD discharges, including 18,387 with a CCHD. Among CHD discharges, CCHD discharges accounted for approximately 46% of total costs (\$806,079,246 of \$1,746,822,993) and 31% of total days (175,804 of 572,378 days). Mean costs for CCHD discharges were 4.3 times those of non-critical CHDs at birth (\$25,340 and \$5,960, respectively). Mean LOS for CCHD discharges was 1.5 times that for non-critical CHDs at birth (7.3 and 4.8 days, respectively). Mean costs were higher for CCHD compared to non-critical CHD discharges at all ages; differences between mean LOS among CCHD and non-critical CHD discharges decreased with increasing age. These baseline estimates of hospital resource use for CCHD could inform future evaluations of the impact of newborn CCHD screening.

**Vitamin D deficiency is associated with increased incidence of gastrointestinal and ear infections in school-age children**

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Vitamin D deficiency (VDD) is highly prevalent among children worldwide. The effects of VDD include alterations of the immune response and increased risk of infection but little evidence exists in school-age children. We investigated the association of vitamin D status with morbidity in a prospective study of school-age children from Bogoto, Colombia. We measured plasma 25-hydroxyvitamin D [25(OH)D] concentrations in a random sample of 475 children (mean  $\pm$  SD age:  $8.9 \pm 1.6$  y) and followed them for an academic year. Caregivers were asked to record daily information on the incidence of morbidity episodes using pictorial diaries. Baseline vitamin D status was classified according to 25(OH)D concentrations as deficient ( $<50$  nmol/L), insufficient ( $\geq 50$  and  $<75$  nmol/L), or sufficient ( $\geq 75$  nmol/L). We used Poisson regression to estimate incidence rate ratios (IRR) and 95% confidence intervals (CI) for days with diarrhea, vomiting, diarrhea with vomiting, cough with fever, and ear ache or discharge with fever, comparing vitamin D-deficient to -sufficient children. Estimates were adjusted for child's age, sex, and household socioeconomic status. The prevalence of vitamin D deficiency was 10%; an additional 47% of children were vitamin D-insufficient. VDD was associated with increased rates of diarrhea with vomiting (adjusted IRR: 2.05, 95% CI: 1.19, 3.53) and ear ache/discharge with fever (adjusted IRR: 2.36, 95% CI: 1.26, 4.44). VDD was not significantly related to cough with fever. These results suggest that VDD is related to increased incidence of gastrointestinal and ear infections in school-age children.

**B19**

**Long-term outcomes in offspring of mothers with hyperemesis gravidarum and trend of hyperemesis gravidarum from 1977 to 2008**

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Hyperemesis gravidarum (HG) is a severe and persistent form of nausea and vomiting during pregnancy. It affects up to 3% of pregnant women. The risks of under-nutrition in pregnant women with HG are well known and it may affect fetus. According to the DOHaD (Developmental Origin of Health and Disease) hypothesis, the fetus respond to under-nutrition and this response may lead to metabolic diseases in adult life. We hypothesized that children born by pregnant women with HG have an increased risk of diabetes mellitus. We set up a population-based cohort using several national registries in Denmark to study risk of diabetes mellitus in offspring. We also explored trend of HG from 1977 to 2008. The number of HG peaks at 8th gestational week and then declines until 16th gestational week. Trend of HG is relatively stable over the years. A cohort of 1,865,997 children, in which 20497 (1.10%) children exposed to HG, were followed from the day of birth up to 34 years of age (median 15.98 years of age). Children born to mothers with HG had a lower birth weight (-33.82 gram, 95%CI: -42.06, -25.58). No excess risk of diabetes mellitus before 10 years of age but then a modest increase was observed in children of mothers with HG. Hazard ratio in exposed children was 0.99 (0.54, 1.79) for  $0 \leq \text{age} < 5$ , 1.23 (0.75, 2.02) for  $5 \leq \text{age} < 10$ , 1.06 (0.63, 1.76) for  $10 \leq \text{age} < 15$ , 2.01 (1.29, 3.13) for  $15 \leq \text{age} < 20$ , 1.16 (0.64, 2.10) for  $20 \leq \text{age} < 25$ , and 1.34 (0.79, 2.27) at age  $> 25$ .

**B20**

**Heterogeneity of respiratory distress syndrome (RDS): Risk factors and morbidity associated with RDS at earlier and later gestation**

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Background: RDS is considered a disease caused by lung immaturity. However, the gestational age-specific incidence of RDS shows a bimodal distribution, suggesting that RDS occurring at earlier and later gestation represents two distinct disease entities. We explored the risk factors and morbidity associated with earlier and later gestation RDS. Methods: Live births in the United States (2005-06) between 24 and 43 weeks gestation with information on RDS status (n=4,368,265) were included. Logistic regression was used to model risk factors for RDS at gestational ages 24-31, 32-36, 37-38, and  $\geq 39$  weeks, with all ongoing pregnancies in each category included. Results: Older maternal age and smoking had similar effects on earlier and later gestation RDS. Effects of several factors were significantly different for early vs late gestation RDS; maternal diabetes was not associated with RDS  $< 32$  weeks (OR 1.03, 95% CI 0.93-1.14) but a risk factor for RDS at  $\geq 39$  weeks (OR 1.50, 95% CI 1.31-1.73). Similarly, maternal age  $< 20$  years, multi-fetal pregnancy, hypertension, placental abruption/previa and cesarean delivery had significantly different effects. Labour induction (OR 0.18, 95% CI 0.16-0.20) and small-for-gestational age (OR 0.56, 95% CI 0.52-0.61) were protective of RDS  $< 32$  weeks but risk factors for RDS  $\geq 39$  weeks (OR 1.19, 95% CI 1.11-1.27 and OR 1.52, 95% CI 1.39-1.67, respectively). Neonatal morbidity (e.g., 5 min Apgar $< 4$ , seizures) was also differentially associated with RDS  $< 32$  vs RDS  $\geq 39$  weeks. Conclusion: The risk factors and morbidity correlates of earlier and later gestation RDS suggest that RDS represents a heterogeneous disease entity.

**B21**

**Age at autism spectrum disorder (ASD) diagnosis by race/ethnicity among children with special health care needs, 2009-2010 National Survey of Children with Special Health Care Needs (NS-CSHCN)**

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Background: ASD prevalence has increased and mean age at ASD diagnosis has decreased among US children. Studies of diagnosis age by race/ethnicity are limited. Methods: From the 2009-2010 NS-CSHCN, we selected 3,025 3-17-year-old children whose parent reported a current ASD diagnosis. We compared ASD prevalence and mean and percentage distributions of diagnosis age across 4 racial/ethnic and primary household language groups: non-Hispanic white, any language (NHWA); non-Hispanic black, any language (NHBA); Hispanic, any race, English (HAE); and Hispanic, any race, other language (HAO). Among children aged >5 years, we additionally assessed findings by ASD severity and adjusted for family sociodemographics. Results: ASD prevalence estimates were 15.3 (NHWA), 10.4 (NHBA), 14.1 (HAE), and 5.2 (HAO) per 1000 US children. Among children aged 3-4 years, mean diagnosis age was comparable across racial/ethnic groups. Among older children, mean diagnosis age was 5.1 (NHWA), 4.6 (NHBA), 4.7 (HAE), and 3.3 (HAO) years. However, results varied by ASD severity. Among mild/moderate ASD cases, NHWA children had a significantly higher proportion (53.8%) of late diagnoses (>5 years of age) than NHBA (38.0%) or HAO children (20.3%). Among severe ASD cases, NHWA children had a lower (albeit non-significant) proportion (19.0%) of late diagnoses than NHBA (40.0%), HAE (32.5%), and HAO children (34.5%). Conclusions: NHWA children have both higher ASD prevalence and a higher proportion of late diagnoses than NHBA and HAO children. The diagnosis age finding is limited to mild/moderate cases. Lower prevalence in these minority groups may reflect failure to identify mild/moderate cases among older children.

**Maternal pre-pregnancy body mass index and autism spectrum disorders among offspring****Getz KD\*, Jick SS****(Boston University School of Public Health, Department of Epidemiology, Boston, MA)**

Previous studies have attributed high maternal weight gain during pregnancy and pre-pregnancy obesity to a higher risk for autism spectrum disorders (ASD). Some studies were limited in part by small sample size and a reliance on self-reported heights and weights. Maternal underweight was not previously explored with respect to ASD risk. We evaluated the association between maternal pre-pregnancy body mass index (BMI) and ASD occurrence among singletons born into the General Practice Research Database from 1993 through 2010. Cases were children with a diagnosis on the autism spectrum from birth through 2010. Four controls were matched to each case on birth year, sex, and general practice. Non-linearity of the association between maternal BMI and ASD was assessed with restricted cubic splines. All study subjects were classified based on maternal BMI using the WHO Classification Standard. Conditional logistic regression was used to calculate crude and multivariable adjusted odds ratios for the association between categorical BMI (reference=normal weight) and the occurrence of any ASD and specific ASD subtypes. The association between maternal BMI and ASD occurrence was non-linear and J-shaped ( $p=0.003$ ). The adjusted ORs for maternal underweight and obesity were 1.4 (95% CI: 1.0, 2.1) and 1.5 (95% CI: 1.2, 1.9), respectively, and did not differ by ASD subtype, suggesting that extremes in maternal BMI are associated with modest increases in the risk for ASD among offspring.

**Secular trends of overweight and obesity prevalence from 2007 to 2011 in children and adolescents in Guangzhou, China**

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Overweight and obesity in children and adolescents have become a serious health problem in China. This study aimed to analyze the secular trends of overweight and obesity prevalence from 2007 to 2011 in children and adolescents (7-18 years old) in Guangzhou, the largest and leading city in southern China. Cluster sampling was conducted among primary schools and secondary schools in Guangzhou. Height and weight were measured in 2007 (n = 26055, boys 13329, girls 12726) and in 2011 (n = 35664, boys 18451, girls 17213). Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared. Overweight and obesity were defined as BMI greater than P85 and P95 respectively according to the BMI reference of Chinese children and adolescents. Prevalence of obesity in children and adolescents significantly increased from 5.17% in 2007 to 6.16% in 2011 (P = 0.003). The prevalence was at the peak in children of 9 and-10 years old in 2007 (10.36%) and 2011 (10.57%) respectively. Obesity was more common in boys than girls in both 2007 and 2011 (both P < 0.001), with the prevalence of 6.87% in 2007 and 8.25% in 2011(P =0.007 for the increase) and no significant increase in girls. Prevalence of overweight also increased from 9.56% in 2007 to 10.74% in 2011 but the increase was not statistically significant (P = 0.204). In conclusion, the prevalence of obesity is high and increasing in children and adolescents, particularly in boys, in Guangzhou, China.

**B24**

**Risk of respiratory conditions among infants born to refugee and non-refugee immigrant women in Ontario, Canada**

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Background: Infants born to refugee mothers may be at higher risk of respiratory conditions compared to those of non-refugee immigrant mothers. It is unknown if this association varies by maternal country or region of birth. Objective: To determine whether infants born to refugee mothers are at higher risk of respiratory conditions compared to non-refugee mothers of the same countries or regions. Methodology: We linked two population-based databases (1985-2010), the Ontario portions of the: Discharge Abstract Database containing diagnostic information on all hospital delivery-birth admissions; and the Citizenship & Immigration Canada database, which contains objective information on most legal immigrants, their refugee status and socio-demographic characteristics. Log-binomial regression was used to examine risk of respiratory outcomes across maternal country and world region of birth, stratified by arrival year. Relative Risks were adjusted (ARR) for maternal age and socio-demographic characteristics. Results: Infants born to refugee women from the Asia-Pacific (n=23,933) and the Africa-Middle East (n=25,863) regions were at significantly higher risk of respiratory conditions compared to their non-refugee same-region counterparts (n=228,617 and n=59,954, respectively) with ARR of 1.08 (95% confidence interval [95% CI]: 1.06-1.11) and 1.04 (95% CI: 1.02-1.06). Infants born to Sri Lankan refugee women were also at significantly higher risk (ARR=1.05, 95% CI: 1.02-1.09). Higher ARRs were also seen across various strata of arrival year. Conclusion: Ontario infants born to refugees from the Asia-Pacific and Africa-Middle East regions as well as Sri Lanka experienced slightly higher risk of respiratory conditions. Our approach may assist in identifying specific at-risk refugee populations.

**Effect of neonatal weight change on child adiposity at 4-5 years of age - Generation XXI birth cohort study****Fonseca MJ\*, Correia S, Barros H, Santos AC  
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We aim to evaluate the effect of weight change in the first 96 hours of life on child adiposity, measured by body mass (BMI), fat mass (FMI), and fat-free mass indexes (FFMI), waist circumference (WC), and waist-to-height ratio (WHtR), measured at 4-5 years of age. Generation XXI included 8647 newborns recruited between 2005/2006 at the public units providing obstetrical and neonatal care in Porto. Information was gathered by face to face interview and additional data abstracted from clinical records. Neonatal anthropometrics were obtained by trained interviewers and the neonatal weight loss (NWL) was estimated as [weight - birth weight (BW)] / BW 100, adjusted for age in hours and categorized as excessive NWL [below 10th percentile of the distribution of weight change ( $\leq -9.6\%$  of BW)], normal NWL [between 10th and 90th percentiles ( $-9.5\%$  to  $-4.3\%$ )] and insufficient NWL [above 90th percentile ( $\geq -4.2\%$ )]. At age 4-5, children were reevaluated according to standard procedures. We present life course data for 875 normal term singletons. Adjusted regression coefficients and 95% confidence intervals [ $\beta$  (95%CI)] were computed using generalized linear models. Children with excessive NWL had a reduction in BMI [-0.471 (-0.878; -0.064)], FFMI [-0.294 (-0.556; -0.033)] and WHtR [-0.011 (-0.020; -0.002)] and children with insufficient NWL had a reduction in WHtR [-0.010 (-0.019; -0.002)], both compared with normal NWL children. This study provides evidence for a long term effect of weigh changes in the first few days of life on the amount and distribution of adiposity.

**Is restricted fetal growth associated with later adiposity?**

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Background: Studies reporting associations between low birth weight (BW) for gestational age (GA) and later obesity and truncal adiposity have not measured body composition and are plagued by residual confounding. Methods: 13,879 (81.4%) of 17,046 Belarusian term-born children enrolled at birth were followed up at age 11.5 years with standardized measures of height, sitting height, weight, BMI, waist and hip circumferences, triceps and subscapular skinfolds (TSF and SSF), and bioimpedance measures of body fat. Multilevel models were used to account for clustered measurement and to control for maternal and paternal height and BMI, maternal education, geographic region, urban vs rural residence, and child's exact age at follow-up. Results: Children born SGA (BW <10th percentile for GA; n=1247, 9.0%) had significantly shorter stature [adjusted mean difference = -1.1 (95% CI -1.5, -0.6) cm] and leg length [-0.6 (-0.9, -0.2) cm] and lower BMI [-0.4 (-0.6, -0.2) kg/m<sup>2</sup>], fat mass index [-0.2 (-0.3, -0.03) kg/m<sup>2</sup>], triceps SF [-0.6 (-1.0, -0.2) mm], and waist [-0.8 (-1.3, -0.3) cm] and hip [-1.1 (-1.6, -0.6) cm] circumferences than those with BW 10th-90th percentiles. No difference was observed in waist:hip ratio, although the SSF:TSF ratio was slightly higher [+0.02 (+0.01, +0.03)] in children born SGA. Conclusions: 11.5-year-old Belarusian children born SGA are shorter, thinner, and have less body fat and lean mass than their non-SGA peers, although their fat may be distributed more truncally.

**Prenatal exposure to Diethylstilbestrol and obesity in middle-aged women****Hatch EE\*, Troisi R, Palmer JR, Wise LA, Titus L, Ricker W, Hyer M, Hoover RN  
(Boston University School of Public Health)**

Diethylstilbestrol (DES) is a non-steroidal estrogen commonly prescribed during pregnancy in the mid-1900's. DES has been linked with reproductive tract malformations, cancer, infertility, and earlier menopause in prenatally exposed daughters. DES was used for growth promotion in animal production, and animal studies suggest an association with obesity. Using data from the National Cancer Institute DES Follow-up Study, we evaluated DES and obesity among 2927 prenatally exposed and 1396 unexposed women. Weight and height were collected by mailed questionnaire in 2006; tape measures were sent to participants for waist circumference (WC). We used multivariable log-binomial and linear regression to calculate risk ratios (RR) for obesity and mean differences (b) in body mass index (BMI) and waist circumference (WC), respectively. The RR for obesity comparing DES exposed with unexposed was 1.09 (95% confidence interval (CI):0.97, 1.22), and 1.11, CI: 0.95,1.31 in never smokers. Among the ~40% with DES dose, the RRs were 1.10 (CI: 0.89, 1.36), 1.26 (CI: 1.02, 1.55), and 1.26 (CI: 1.06, 1.50), for <2500, 2500-9999, and >10,000 mg compared with no exposure. The RRs for obesity increased slightly with later age at first exposure; RRs (CIs) were 0.98 (0.82, 1.18), 1.15 (0.97,1.37), 1.16 (0.96,1.39), and 1.20 (1.02,1.41) for first exposure at ≤7, 8-10, 11-14, and >15 weeks gestation, respectively, relative to no exposure. DES exposed had slightly higher mean BMI (b=0.30, CI: -0.12, 0.71), but differences in WC (cm) were minimal (b=0.08, CI:-0.97, 1.13). This study suggests a small increase in obesity, but not central adiposity, among DES-exposed women.

**National survey of attitudes towards breastfeeding among U.S. males ages 21-44****Van Wagenen S\*, Magnusson B, Fugal S, Van Wagenen K, Beckstrand J  
(Brigham Young University)**

Objective. Define male attitudes towards breastfeeding in the U.S. Methods. Participants were recruited from a national survey panel. The sample (n=500) was restricted to males, aged 21-44 years, living in the U.S. For sufficient variation in fatherhood status, both groups (fathers and non-fathers) consisted of 250 participants. Similarly, sampling quotas for race and ethnicity were used to ensure a sample representative of the racial distribution in the U.S. population. The Theory of Reasoned Action influenced development of survey items. The instrument includes the 17-question Iowa Infant Feeding Attitude Scale (IIFAS), 10 demographic questions adapted from BRFSS, and 23 questions regarding exposure and knowledge used from previous research. The IIFAS scale was first validated among men in 2004, and had good internal reliability among males ( $\alpha = 0.77$ ). A previous study validated a Likert-scale of level of agreement with positive and negative adjectives describing images of women breastfeeding in a variety of situations ( $\alpha$  positive= 0.79;  $\alpha$  negative= 0.89). Data Analysis. Using SAS 9.3, bivariate analyses will be conducted to determine the relationship between demographic factors and breastfeeding attitudes, as measured by the IIFAS, and proportions reported. Mean scores for the IIFAS will be calculated overall, for different demographic sub-groups, and will be compared using t-tests and ANOVA. Conclusion. Analysis of results is not completed. It is anticipated that once attitudes are better defined, interventions aimed at improving breastfeeding rates can be more successfully tailored to fathers and to men without children.

**B29**

**Changes in severity of developmental delays in a longitudinal sample of infants and toddlers**

**McManus BM\*, Robinson C, Rosenberg S  
(University of Colorado)**

Background: Frequent developmental screening is recommended because developmental delays are presumed to be dynamic. Yet, little is known about the persistence of young children's developmental delays. Methods: In a sample (n=8,950) derived from the Early Childhood Longitudinal Study, Birth cohort, we examined developmental changes between 9- and 24 months. Motor and cognitive delays were measured using the Bayley Short Form-Research Edition, and categorized as none (i.e., within 1 SD below the mean), mild (i.e., between 1 and 1.5 SD below the mean), and moderate/severe (more than 1.5 SD below the mean). Adjusted ordinal logistic regression models estimated the odds of worse developmental delay for each category of developmental delay at 9 months controlling for social characteristics of families. PROC survey procedures in SAS were used to account for the complex sampling scheme of the ECLS-B. Results: Overall, 24% of children had a cognitive function delay and 27% had a motor function delay at any timepoint. About (73%) of children with any cognitive delay at 9-months had normal cognitive function at 24-months. Children with moderate/severe cognitive delay at 9-months had 3 times the odds (aOR=3.31, 95% CI=2.6, 4.3) of having worse cognitive function at 24-months compared to children with no cognitive delay at 9-months. Conclusions: Developmental delays in infants are dynamic and complex. The majority of developmental delays will resolve by 24 months, but a substantial minority of children will have persistent or later-emerging delays.

**Initial results of the Creighton Model Effectiveness, Intentions, Behaviors Assessment study****Stanford JB\*, Porucznik CA, Ostler KC, Krakowiak DS, Singh N  
(University of Utah School of Medicine, Division of Public Health, Salt Lake City, UT)**

We recruited a cohort of 306 couples initially using Creighton Model natural family planning to avoid pregnancy and followed them prospectively for 12 months of use measuring the pregnancy intentions of male and female partners separately at the start of each menstrual cycle. At enrollment, 79% of women and 81% of men reported that they definitely or mostly wanted a pregnancy in the future despite their current intention to avoid pregnancy. During 2,768 follow-up cycles, 37% of women and 31% of men changed their pregnancy intention from avoiding to achieving or undecided, and 118 couples (38%) conceived. Male and female pregnancy intention (avoid or achieve) was mostly concurrent with complete agreement for 88% of cycles and 5.7% of cycles in which the disagreement was caused by neutral intention of one partner. Opposite intention was reported in only 2.4% of cycles. Among the 93 conception cycles for which the fertility charts have undergone expert review, the large majority (71%) of pregnancies were associated with intercourse on a known day of fertility (achieving-related behavior) while 9.7% were associated with incorrect use of the system, 4.3% were associated with incorrect use and teaching; and 5.4% occurred despite apparently correct use of the system to avoid pregnancy. Only 6% of conceptions occurred during cycles for which the woman had expressed intention to avoid pregnancy. Pregnancy intention is a fluid concept, and evaluation of the true effectiveness of any family planning must take into account the intention of the couple at the time of conception.

**Interim results from the international NaProTechnology evaluation and surveillance of treatment (iNEST)****Stanford JB\*, Parnell T, Lowe M, Kim J  
(University of Utah, Salt Lake City, UT)**

Background: NaProTechnology is an approach to fertility that combines education to the couple, thorough medical evaluation, and targeted medical intervention that cooperates with and enhances natural fecundity. Methods: The International NaProTechnology Evaluation and Surveillance of Treatment for infertility and miscarriage (iNEST) study is a multi-site, multi-national longitudinal cohort study with the aim to follow subfertile couples for 3 years after their first medical consult seeking to conceive or maintain a pregnancy. All patient couples presenting at one of the six currently participating clinics for help with conceiving or maintaining pregnancy are eligible. Interim Results: To date, 309 couples have enrolled in the study. The mean women's age is 33 years, 20% have been pregnant before, and the mean time the couples have been trying to conceive at entry is about 3 years. The crude pregnancy rate to date (not adjusting for drop-outs) is 44%, with a mean time to pregnancy in the study of 9 months. About half of couples have completed follow-up questionnaires at 1, 2 and/ or 3 years: these reveal that 80% received at least some NaProTechnology treatment, and 64% received some other type of medical or alternative treatment during the study period. Using satisfaction measures previously validated for other fertility treatments, there was a high degree of reported satisfaction with NaProTechnology treatment. Conclusions: In this clinic-based population, multiple methods of fertility treatments were common; evaluation of treatment outcomes will require longitudinal analytic methods with significant time-varying treatment exposures.

**Biospecimen collection timed to self-identified ovulation: compliance in a prospective cohort study****Porucznik CA\*, Cox KJ, Schmidt LC, Stanford JB  
(University of Utah, Salt Lake City, UT)**

We began recruitment (ongoing) for a prospective, pre-conception cohort of couples without known infertility in Utah in early 2012 and report preliminary findings of protocol compliance from the first 108 participants. The protocol requires that couples collect urine, saliva, and semen specimens at specified times during up to two menstrual cycles. Couples observed cervical mucus to identify an estimated day of ovulation (EDO) and associated fertile window. Participant couples were instructed to collect first-morning urine samples beginning during the fertile window, after which men discontinued collecting but women collected daily for the remainder of the cycle. They were to collect saliva two days after the EDO, and semen between EDO and the end of the cycle. Among men, 239 urines were expected and 248 (104%) were collected. The majority of samples corresponded correctly to the fertile window (164, 66%) with an additional 77 (31%) collected after and 7 (3%) collected before the fertile window. Among women, 936 samples were expected and 817 (87%) were submitted, primarily during the collection period (772, 94%) with an additional 36 (4%) collected after (during the next cycle) and 9 (1%) collected prior to the collection period (before the fertile window). Saliva compliance was high among both men (79/83, 95%) and women (80/83, 96%). Semen sample collection was less compliant with 76/83 (92%) of expected specimens collected. These results suggest that this study population is able to comply with biospecimen collection of urine, saliva, and semen in accordance with the study protocol.

**Fecundability in women born preterm**

**Wildenschild C\*, Riis AH, Ehrenstein V, Hatch EE, Wise LA, Rothman KJ, Sorensen HT, Mikkelsen EM**

**(Department of Clinical Epidemiology, Aarhus University Hospital)**

Background: An estimated 6-15% of pregnancies result in a preterm birth. Infants born preterm are at increased risk of adverse health outcomes, which may persist in adult life. Studies have found that women born preterm may have a decreased probability of giving birth, but precise data on the cycle-specific probability of conception (fecundability) in such women are lacking. Methods: We examined the fecundability of women born preterm in a prospective cohort study of 2,814 Danish pregnancy planners. Self-reported prospectively collected data on time to pregnancy were supplemented by data on gestational age obtained from the Danish Medical Birth Registry. We estimated fecundability ratios (FR) and 95% confidence intervals (CI) for women born preterm (<37 weeks), and women born postterm ( $\geq 42$  weeks), relative to women born at term (37 weeks - 41 weeks 6 days) using proportional probabilities regression models. Results: Relative to women born at term, the FRs were 0.87 (95% CI 0.66;1.13) for women born preterm, and 1.09 (95% CI 0.93;1.28) for women born postterm. After adjustment for birth year, weight at birth, and participants' mothers' socio-demographic, medical and reproductive characteristics, the FRs were 0.91 (95% CI 0.68;1.24) for women born preterm and 1.09 (95% CI 0.93;1.28) for women born postterm. Conclusion: Our data do not support the hypothesis that being born preterm is associated with a decrease in fecundability.

**Phytoestrogens and couple fecundity: the LIFE study**

**Mumford SL\*, Sundaram R, Maisog J, Schisterman EF, Barr D, Sweeney A, Louis GM (Eunice Kennedy Shriver National Institute of Child Health and Human Development, Rockville, MD)**

Phytoestrogens have been associated with subtle hormonal changes, though effects on fecundity are unknown. Our objective was to evaluate the association between male and female urinary phytoestrogen (isoflavone and lignan) concentrations and time-to-pregnancy (TTP) among a population based cohort of 501 couples desiring pregnancy and discontinuing contraception who were followed for 12 months or until pregnancy. Fecundability odds ratios (FORs) and 95% confidence intervals (CIs) were estimated adjusting for age, body mass index, race, site, triglycerides, creatinine, supplement use, and physical activity, in relation to female, male, and joint couple exposures. FORs <1 denote a longer TTP and models included the phytoestrogen of interest and the sum of the remaining individual phytoestrogens. Urinary lignan levels were observed to be higher on average among female partners of couples who became pregnant during the study (enterodiol, median 35.8 vs 24.3 mcg/L,  $P < 0.05$ ; enterolactone, median 295.5 vs. 123.0 mcg/L,  $P < 0.05$ ), and were associated with significantly shorter TTP in models based upon both individual and couples exposures (couple exposure models: enterodiol FOR 1.15, 95% CI 1.02, 1.29; enterolactone FOR: 1.10, 95% CI: 1.00, 1.20). Male exposure to lignans was not associated with TTP. Isoflavone levels were not associated with TTP. Sensitivity analyses showed that associations observed are unlikely to be explained by potential unmeasured confounding by other nutrients. Our results suggest that female urinary lignan concentrations at levels characteristic of the US population are associated with a shorter TTP among couples attempting to conceive, highlighting the importance of dietary influences on fecundity.

**Characterizing the use of fertility preservation methods among female cancer survivors:  
The FUCHSIA Women's Study****Chin HB\*, Knight JH, Hartnett KP, Kim KH, Spencer JB, Howards PP  
(Rollins School of Public Health, Emory University, Atlanta, GA)**

Cancer survival rates continue to improve, making it increasingly important to address the long-term health effects of cancer treatments, such as impaired fertility. Although not routine, it is becoming more common for young women to be referred to a fertility specialist before they begin cancer treatment. There were 839 cancer survivors in the FUCHSIA Women's Study who received potentially gonadotoxic chemotherapy and/or radiation as part of their cancer treatment. Of these women 21.1% (n=177) discussed fertility preservation before cancer treatment and 3.7% (n=31) used a fertility preservation method. Among the survivors who used fertility preservation, 45.2% (n=14) took drugs to suppress ovarian function, 38.7% (n=12) attempted egg retrieval to preserve eggs or embryos, 6.5% (n=2) used both, and 9.7% (n=3) used another method. Thirteen women who attempted egg retrieval were successful; 2 preserved eggs, 9 preserved embryos, and 1 preserved both (n=1 refused). A mean of 6.3 and 5.9 years elapsed between the time of preservation to the interview for women who preserved eggs and embryos, respectively. None of the women who preserved eggs tried to use them by the time of the interview. Three of the women who preserved embryos had attempted pregnancy using preserved embryos by the time of the interview and 2 became pregnant. Both women had single live births. Although fertility preservation is becoming more common, its use is still limited and data on the ability to achieve pregnancy following the use of a preservation method is just beginning to become available.

**Understanding young adult cancer survivors' knowledge about fertility preservation and their reasons for not pursuing it in the FUCHSIA Women's Study****Kim KH\*, Hartnett KP, Chin HB, Knight JH, Woodard JJ, Spencer JB, Howards PP  
(Rollins School of Public Health, Emory University, Atlanta, GA)**

Quality of life for cancer survivors has become an increasingly important issue as survival rates improve after treatment. The FUCHSIA Women's Study is a study of fertility in female survivors of young adult cancers (diagnosed between the ages of 20-35). Cancer survivors (n=1243) were asked about the information they received concerning fertility preservation prior to cancer treatment and their decisions regarding that option. Among all cancer survivors, 15% reported having a discussion with a medical professional about fertility preservation prior to cancer treatment (n=185). Survivors of nodal non-Hodgkin's lymphoma were least likely to have discussed fertility preservation prior to treatment (6%), while survivors of Hodgkin's lymphoma were most likely to have discussed fertility preservation prior to treatment (34%) compared to other cancer types. Most cancer survivors who discussed fertility preservation did not pursue it (83%, n=153). When asked why they did not pursue fertility preservation, 29% indicated that one of their reasons was "I did not believe my cancer treatment would affect my fertility" (n=44). There was no difference between the proportion of women who said that they did not believe their cancer treatment would affect their fertility among those who received chemotherapy or radiation versus women who received other types of treatment (22% in each group). Based on our results, most survivors of young adult cancers are not discussing fertility preservation prior to their treatment, and those that are may not understand the information even when they are receiving treatments that are likely to affect fertility.

**Alcohol consumption and time to pregnancy: A Danish prospective cohort study****Mikkelsen EM\*, Riis AH, Hatch EE, Wise LA, Rothman KJ and Sorensen HT  
(Department of Clinical Epidemiology, Aarhus University Hospital)**

Some studies have found alcohol consumption to be associated with decreased fecundability whereas others have found no such association or even indicate a positive association between moderate alcohol intake and fecundability. We evaluated the association between consumption during the preconception period of any alcohol, as well as specific categories of alcohol-containing beverages (beer, wine and spirits), and time to pregnancy (TTP). We examined these relations in a prospective cohort study of 3,895 Danish female pregnancy planners. Data were self-reported via internet-based questionnaires at baseline and updated every two months for a year or until conception occurred. Participants were asked to consider their alcohol intake during the past month and report their average weekly consumption in standard servings (bottles of beer (330 ml), glasses of red or white wine (120 ml), dessert wine (50 ml), and spirits (20 ml)). We used a proportional probabilities regression model to estimate fecundability ratios (FRs) and 95% confidence intervals (CIs). Compared with no alcohol consumption, the FRs for consumption of 1-3, 4-7, 8-13 or  $\geq 14$  servings per week were 0.95 (95% CI=0.88-1.03), 1.01 (95% CI=0.91-1.12), 1.01 (95% CI=0.84-1.20) and 0.77 (95% CI=0.52-1.12), respectively, after adjustment for demographic, socioeconomic and lifestyle factors. We observed no relation between TTP and category of alcohol-containing beverage consumed after mutual adjustment for alcohol types. Our data indicate that pre-conception alcohol consumption of less than 14 servings per week is not materially associated with TTP. Greater consumption, however, may be associated with a slight delay in TTP.

**Cycle-specific phthalate measures, early pregnancy loss and time to pregnancy****Jukic AM\*, Weinberg CR, Hoppin JA, Longnecker MP, Baird DD, Wilcox AJ  
(National Institute of Environmental Health Sciences, Durham, NC)**

A recent study found a strong association between high maternal levels of monoethylhexyl phthalate (MEHP) and early pregnancy loss (*Environ Health Perspect*, 2012, 120:458-463). We used data from the North Carolina Early Pregnancy Study (EPS) (1982-86) to examine urinary phthalate metabolite levels and early pregnancy loss (loss prior to 6 weeks gestation). Women discontinuing contraception collected first-morning urine specimens and reported menstrual bleeding and sexual intercourse. Urine specimens were analyzed for estrogen and progesterone metabolites and human chorionic gonadotropin. Phthalate metabolites were measured in pooled urine samples drawn from three daily specimens across each menstrual cycle. Odds ratios for early loss, adjusted for age and season, were estimated with logistic regression. The median MEHP level was 6.7 ng/ml. (interquartile range 4.0, 11.1). There were 150 clinical pregnancies, and 48 early pregnancy losses. We saw no association of MEHP with early pregnancy loss (for the two highest tertiles compared with the lowest, odds ratios for early loss were (CI): 1.7 (0.7, 4.5), 1.1 (0.4, 2.9)). We also considered the number of ovulatory cycles required to achieve pregnancy (N=711). We estimated fecundability ratios, adjusted for age and ever-smoking, with log linear regression. There was no evidence of reduced fecundability with MEHP exposure (two highest tertiles, fecundability ratios (CI) 1.3 (0.98, 1.9), 1.6 (1.1, 2.5)). (A ratio above one suggests higher fecundability.) Results for the molar sum of di-(2-ethylhexyl)phthalate metabolites and other measured phthalate metabolites were similarly negative. In sum, we found no evidence of detrimental phthalate effects on fertility.

**Are young women with cancer getting enough information about the possible effects of treatment on their future fertility? An analysis from the FUCHSIA Women's Study**

**Hartnett KP\*, Kim KH, Chin HB, Knight JH, Spencer JB, Howards PP  
(Rollins School of Public Health, Emory University, Atlanta, GA)**

Women diagnosed with cancer during their childbearing years often need chemotherapy or radiation, which can cause infertility. While fertility preservation options are increasingly available, it is unclear whether women are getting enough information to make informed decisions before treatment. The FUCHSIA Women's Study recruited 1,243 women diagnosed with cancer between the ages of 20 and 35. Among these survivors, 59.4% agreed with the statement: "I received enough information about the possible effects of cancer treatment on my future fertility from a medical professional prior to my treatment." However, 17.9% disagreed and 8.9% strongly disagreed. The proportions were similar among the 839 women treated with chemotherapy and/or radiation: 17.8% disagreed and 8.3% strongly disagreed. Household income, education, race, ethnicity, time since diagnosis, and whether a woman already had biological children or was living with her current partner when diagnosed were not associated with receiving enough information. Among women who received chemotherapy or radiation, 58.2% talked with a doctor about how treatment could affect their fertility. Of these discussions, 41.8% were initiated by oncologists and 37.2% were initiated by the women. Women who said it was too stressful to consider fertility before cancer treatment were more likely to feel satisfied with the information they did receive (aOR=2.6, 95% CI: 1.6, 4.0). Survivors who initiated the discussion about fertility were more likely to report receiving enough information (aOR=3.1, 95% CI: 2.0, 4.9). Oncologists need to improve fertility counseling at the time of diagnosis, particularly for women who do not raise the subject.

**Indicators of luteal phase deficiency among healthy premenopausal women**

**Schliep KC\*, Hammoud AO, Mumford SL, Stanford JB, Porucznik CA, Kissell KA, Wactaswki Wende J, Schisterman EF**  
**(Eunice Kennedy Shriver National Institute of Child Health and Human Development, Bethesda, MD)**

While adequate luteal hormone production is necessary for establishing a pregnancy, luteal phase deficiency (LPD) is poorly characterized. We assessed reproductive hormone concentrations associated with LPD by following 259 healthy, regularly menstruating women, ages 18-44 from western New York, for up to 2 menstrual cycles. LPD was assessed by: 1) luteal phase duration <10 days, 2) peak luteal progesterone <5 ng/mL, and 3) premenstrual spotting. Daily menstrual bleeding records determined cycle lengths and day of ovulation was determined by urine luteinizing hormone (LH) surge. Analyses were restricted to ovulatory cycles with known cycle length (n=411 cycles). Serum estradiol (E2), progesterone, LH, and follicle stimulating hormone (FSH) were measured up to 8 times/cycle. Mean area under the cycle-specific curves were compared by LPD status, using mixed model analyses. 9.5% of cycles had luteal durations <10 days, 8.3% had luteal progesterone <5 ng/mL, and 2.1% had premenstrual spotting. 3.4% of cycles had luteal durations <10 days and progesterone <5 ng/mL. No cycles met all 3 criteria. Luteal phase <10 days was associated with overall lower E2 (P < 0.001), progesterone (P < 0.001), LH (P = 0.02), and FSH (P = 0.03), after adjusting for woman's age and race. Luteal progesterone ≤ 5 ng/mL was associated with lower E2 (P < 0.001) and progesterone (P < 0.001). Premenstrual spotting was not significantly associated with mean area under the curve hormone concentrations. Findings suggest that normal cycling women do express evidence of subtle menstrual disorders consistent with LPD, but potentially through different mechanisms.

**B41**

**Is infertility treatment independently associated with symptoms of postpartum depression?**

**C Lynch\***

**(The Ohio State University College of Medicine, Columbus, OH)**

There is dearth of data regarding the association between infertility treatment and postpartum mental health status. To address this gap, I used 2009 and 2010 data from the Pregnancy Risk Assessment Monitoring System (PRAMS). Infertility treatment status was as reported on the birth certificate. Maternal mental health was obtained via the maternal questionnaire. All data were analyzed in Stata 12.0 with sample weights to produce population-based estimates. Infertility treatment status was missing for 44.7% of women and they were excluded. There were many significant differences in the demographics of women who were and were not included, but the differences were not meaningful save for an increased percentage of women of 'other' races in the analytic sample. Among the 40,337 women, 71.7% were white, 13.0% were black, and 15.3% were of other races and 52.7% were in their 20s. More than half (53.5%) of women had more than a high school education. Only 1.2% of women were categorized as having delivered following infertility treatment. Rates of postpartum sadness did not differ by treatment status (12.9% overall), but feeling hopeless was more common among untreated women (6.0% vs 3.7%). After adjustment for maternal race, age, education, stressors during pregnancy, plurality, prior mental health visits, and NICU admission, the difference was no longer statistically significant [AOR=0.68; 95% CI=(0.40; 1.16)]. Not surprisingly, NICU admission and delivering multiples were associated with statistically significant increases in self-reported postpartum sadness and hopelessness. These data suggest that infertility treatment is not independently associated with postpartum mental health difficulties.

**B42**

**Methods used to evaluate potential biases in vaccine pregnancy safety studies using electronic health data**

**Vazquez-Benitez G\*, Olshen Kharbanda E, Nordin J, Lipkind H, Naleway A  
(HealthPartners Institute for Education and Research)**

Vaccines are increasingly targeted to women of reproductive age and two vaccines, influenza and pertussis, are specifically recommended during pregnancy. Pre-licensure clinical trials do not typically include pregnant women; when included, trials may not enroll enough pregnant women to detect rare events. Thus post-licensure vaccine safety assessments, utilizing electronic health care, are necessary. Our current work in the Vaccine Safety Datalink (VSD) has focused specifically on maternal and infant safety following exposures to vaccines during pregnancy. We have identified several potential challenges utilizing electronic health care data when analyzing exposure-pregnancy outcome associations. Our goal is to discuss specific issues related to cohort identification, timing and temporal trends of vaccination, confounding, and assessment of outcomes. Utilizing a subset of data from two ongoing studies of influenza vaccine safety during pregnancy (AJOG 2012, S47-51), we provide examples and demonstrate analytic strategies to address these issues. Specifically, we demonstrate that significant biases in the vaccine-outcome associations may occur if studies do not adequately adjust for seasonal trends in vaccination and health care utilization patterns. In addition, for maternal and perinatal outcomes, it is important to account for the time-dependency of exposures and outcomes. For example, women with preterm deliveries have less time while pregnant to be vaccinated. Observational studies using electronic health data for pregnancy safety studies must collect relevant covariates and address these potential biases in the analysis phase. Although our methodology has been developed conducting studies of vaccine safety, our findings are relevant across the field of perinatal and reproductive health.

**B43**

**Birth outcomes following a first-born male in an ethnically diverse California population**

**Bruckner TA\*, Catalano R**  
**(University of California, Irvine)**

Research from Scandinavia finds that a giving birth to a first-born male predicts lower birthweight and increased risk of preterm in the subsequent birth. The relevance of the Scandinavian findings to the US, however, remains unclear given the divergent racial/ethnic characteristics of these regions. We use a unique dataset of almost 200,000 mothers, with birth data linked across pregnancies, to test the ‘male virulence’ hypothesis. Using linked files from California’s Genetic Disease Screening Program, we acquired birth data from mothers who delivered consecutive, singleton live births from 2002 to 2007. We estimated the association between male first-born sex and two outcomes: birthweight (using linear regression) and preterm delivery (<37 weeks; using logistic regression). Analyses controlled for interbirth interval, maternal age, sex of second-born offspring, and all other maternal factors that do not vary across the first and second pregnancy. We find support for the ‘male virulence’ hypothesis in that a first born male varies inversely with the subsequent birth’s weight (coef: -22.43 gm, 95% Confidence Interval [CI] = -26.9 to -17.9 gm), but positively with the risk of preterm delivery (OR = 1.12, 95% CI = 1.07 to 1.17). Analyses by racial/ethnic subgroups, however, indicate substantial variation. Non-Hispanic white and Hispanic mothers show associations similar in direction and magnitude to the overall estimates, but non-Hispanic blacks show a null relation. Findings in California support the male virulence hypothesis for some, but not all, race/ethnicities.

**The distribution of first and second trimester serum inflammatory markers in normotensive and preeclamptic pregnancies****Taylor BD\*, Ness RB, Olsen J, Hougaard DM, Skogstrand K, Roberts JM, Haggerty CL (University of Pittsburgh, Pittsburgh, PA)**

Objective: Inflammation is increased during normal pregnancy and further increased in women with preeclampsia. We asked whether the distribution of inflammatory markers differed in the first and second trimester among preeclamptic and normotensive pregnancies. Methods: We studied 43 preeclamptic and 28 normotensive women with first trimester samples and 367 preeclamptic and 269 normotensive women with second trimester samples from the Danish National Birth Cohort. The distribution of interleukin (IL)-6, IL4, IL5, IL12, IL10, IL8, IL18, IL1-beta, interferon (IFN)-gamma, tumor necrosis factor (TNF)-alpha, macrophage migration inhibitory factor (MIF) and transforming growth factor (TGF)-beta were compared by trimester among normotensive and preeclamptic women. Distributional differences between first and second trimester samples were compared by medians. P-values adjusted for body mass index, age, and smoking were calculated by generalized linear models. False discovery rate (FDR) controlled for multiple comparisons. Results: In preeclampsia, multi-functional TGF-beta (medians 1936 vs. 932;p=0.0139), pro-inflammatory MIF (86.4 vs. 71.6;p=0.04), and anti-inflammatory IL4 (52 vs. 17;p=0.1066) were significantly higher in the first trimester, controlling for FDR. Pro-inflammatory IFN-gamma (154 vs.108;p=0.1934) and IL1-beta (258 vs. 211;p=0.1984) were non-significantly increased in the first trimester. In normotensive pregnancies no differences were observed (IL4: 30.5 vs. 20.0, p=0.6635; TGF-beta: 1666 vs. 770, p=0.7563; MIF: 49 vs. 64, p=0.2190; IFN-gamma: 4.0 vs. 93, p=0.5992; IL1-beta: 255 vs. 280, p=0.1636). Conclusions: Among preeclamptic women, serum inflammatory markers were higher in first trimester compared to second trimester samples. Preeclamptic women may have an exaggerated immune response which is greatest in the first trimester, corresponding with abnormal placentation.

**Elevated first trimester maternal serum inflammatory markers predict preeclampsia**

**Taylor BD\*, Ness RB, Klebanoff MA, Hougaard DM, Skogstrand K, Roberts RM, Haggerty CL  
(University of Pittsburgh, Pittsburgh, PA)**

**Objective:** An exaggerated maternal immune response is implicated in abnormal placentation and endothelial dysfunction. Although elevated inflammatory cytokines have been cross-sectionally associated with preeclampsia, few prospective studies have been conducted. We explored elevated first trimester inflammatory markers in preeclampsia. **Methods:** We conducted a nested case-control study of 64 preeclamptic cases and 178 normotensive pregnant controls enrolled in the Collaborative Perinatal Project between 5-13 weeks gestation. Preeclampsia was based on chart abstraction and defined as gestational hypertension ( $\geq 140$  mmHg and/or diastolic blood pressure  $\geq 90$  mmHg after 24 weeks of gestation) and proteinuria (2 urine dipsticks of 1+ protein or one dipstick of 2+ protein). Associations between elevated ( $> 75$ th or 90th percentile) inflammatory markers measured in the first trimester including RANTES, interleukin (IL)-6, IL4, IL5, IL12, IL10, IL8, IL18, IL1-beta, interferon-gamma, tumor necrosis factor-alpha, transforming growth factor-beta and preeclampsia were explored using logistic regression adjusting for body mass index, smoking, race, and maternal age. False discovery rate was used to control for multiple comparisons. **Results:** After adjustment for multiple comparisons, elevated ( $>75$ th percentile) pro-inflammatory IL12 (odds ratio (OR) 2.8, 95% CI 1.4-5.6) and RANTES (OR 2.1, 95% CI 1.1-4.1) were significantly associated with subsequent preeclampsia. Elevated IL10 [ $> 90$ th percentile) OR 4.1, 95% CI 1.1-15.1], IL6 (OR 1.6, 95% CI 0.6-3.9) and IL8 (OR 1.5, 95% CI 0.7-3.0) non-significantly increased the risk of preeclampsia. **Conclusions:** Elevated first trimester serum inflammatory markers may increase the risk of preeclampsia, suggesting an exaggerated immune response in early pregnancy is involved in preeclampsia genesis.

**Private coverage and increased risk of obstetric intervention in Ireland**

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(The National Perinatal Epidemiology Centre, Cork, Ireland)

Background: When clinically indicated, common obstetric interventions can greatly improve maternal and neonatal outcomes. However, variation in intervention rates by type of health care coverage suggests that obstetric practice may not be solely driven by case criteria. Aim: To assess differences in obstetric intervention rates by private and public coverage in Ireland. Methods: Using nationally representative hospital discharge data, a retrospective study was performed on childbirth hospitalizations occurring between 2005 and 2010. Multivariate logistic regression analysis with correction for the relative risk was conducted to determine the risk of obstetric intervention (cesarean delivery, operative vaginal delivery, induction of labor and episiotomy) by private or public patient status while adjusting for obstetric risk factors. Results: 403,642 childbirth hospitalizations were reviewed; one-third (30.2%) were covered privately. After controlling for obstetric risk factors, private patients were more likely to have an elective cesarean delivery (RR: 1.48; 95% CI: 1.45-1.51), an emergency cesarean delivery (RR: 1.13; 95% CI: 1.10-1.14) and an operative vaginal delivery (RR: 1.25; 95% CI: 1.22-1.27). Private patients were 27% more likely to have induction of labor (RR: 1.27; 95% CI: 1.26-1.29). Compared to public patients with a vaginal delivery, private patients were 40% more likely to have an episiotomy (RR: 1.40; 95% CI: 1.38-1.43). Conclusion: Despite the availability of universal maternity care in Ireland, women with private coverage were significantly more likely to have an obstetric intervention. Initiatives to reduce disparities would likely require a multi-dimensional approach which addresses concerns held by both the maternity care provider and the mother.

**Seafood consumption among pregnant women and non-pregnant women of childbearing age in the United States, NHANES 1999-2010**

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Background: Long-chain polyunsaturated fatty acids found in seafood are essential for optimal neurodevelopment of the fetus. However, concerns about mercury contamination of seafood and its potential harm to the developing fetus have created uncertainty about seafood consumption for pregnant women. Purpose: We compared fish and shellfish consumption patterns, as well as their predictors, among pregnant and non-pregnant women of childbearing age in the U.S. Methods: Data from 1,260 pregnant women aged 16-49 years from the 1999-2006 National Health and Nutrition Examination Survey (NHANES), and 8,210 non-pregnant women aged 16-49 years from the 1999-2010 NHANES were analyzed. Frequency and type of seafood consumed and adjusted associations of multiple characteristics with seafood consumption were estimated for pregnant and non-pregnant women, separately. Time trends were also examined. Results: There were no significant differences in the prevalence of fish or shellfish consumption, separately or combined, between pregnant and non-pregnant women. Seafood consumption was associated with increasing age, higher poverty income ratio, and higher education among pregnant and non-pregnant women, and among fish consumers these groups were more likely to consume  $\geq 3$  servings in the past 30 days. Tuna and shrimp were the most frequently reported fish and shellfish, respectively, among both pregnant and non-pregnant women. We observed no time trends. Conclusion: There were few differences in seafood consumption between pregnant and non-pregnant women, and the factors related to seafood consumption were similar for both groups. Our data suggest that many women are not consuming the recommended amount of seafood.

**Postpartum depression and anxiety: Prevalence, comorbidity and risk factors in a population-based sample of women****Farr SL\*, Dietz PM, O'Hara MW, Burley K, Ko JY  
(Division of Reproductive Health, Centers for Disease Control and Prevention, Atlanta, GA)**

The prevalence and risk factors for postpartum anxiety and its comorbidity with depression are not well established. Using multinomial logistic regression, we examined the prevalence and risk factors for postpartum anxiety and depressive symptoms using 2009-2010 data from the Illinois and Maryland Pregnancy Risk Assessment Monitoring System (PRAMS), a population-based survey of mothers who gave birth to live infants. Mothers were asked validated questions on depressive and anxiety symptoms. Mothers were also asked questions on sociodemographic information, smoking status and 18 types of emotional, financial, partner-related and traumatic stressful life events during pregnancy. PRAMS survey data is linked to the infant birth certificate. Among 4,451 postpartum women, 2.7% reported depressive symptoms only, 11.7% reported anxiety symptoms only, and 6.3% reported comorbid depressive and anxiety symptoms. In the multivariable model, experiencing 3-5 and 6-18 stressors, respectively, compared to 0, were associated with depressive symptoms only (adjusted odds ratios (aOR) = 5.5 and 8.1), anxiety symptoms only (aORs= 2.2 and 2.0), and depressive and anxiety symptoms (aOR=4.8 and 9.7). Delivering an infant at  $\leq 27$  weeks gestation was also associated with depressive symptoms only (aOR= 4.3), anxiety symptoms only (aOR=2.0) and comorbid depressive and anxiety symptoms (aOR=5.7). Smoking throughout pregnancy was associated with postpartum anxiety symptoms only (aOR=2.3) and comorbid depressive and anxiety symptoms (aOR=2.9). Given the possible adverse effects of anxiety and depression on maternal health and infant development, clinicians should be aware of the substantial prevalence, comorbidity and risk factors for both conditions and facilitate identification, referral and/or treatment.

**Maternal vitamin D receptor gene polymorphisms, vitamin D status in pregnancy and preterm birth risk****Wei S\*, Fraser WD, and the MIROS study group****(Department of Obstetrics and Gynecology, CHU Sainte-Justine hospital, University of Montreal, Montreal, Canada)**

Objective: Vitamin D is a known immune system modulator and has been shown associated with inflammatory response. Vitamin D's effects are exerted via the vitamin D receptor (VDR) and there is VDR genetic variation in the population. However, there is lack of evidence on how the maternal vitamin D status interact with the VDR gene single nucleotide polymorphisms (SNPs) and risk of spontaneous preterm birth. The aim of this study was to determine the relationships among maternal vitamin D receptor polymorphisms, vitamin D status in pregnancy and risk of preterm birth. Study Design: This is a prospective cohort study of 697 pregnant women. Maternal plasma 25(OH)D at 12-18 weeks gestation were measured using chemiluminescence immunoassay. Polymerase chain reaction/restriction fragment length polymorphism was applied to test the genotype frequency of vitamin D receptor gene polymorphisms [ApaI (rs7975232), BsmI (rs1544410), Cdx2 (rs11568820), FokI (rs2228570), TaqI (rs731236) and Tru91 (rs757343)]. Results: Maternal vitamin D receptor gene BsmI and TaqI polymorphisms were associated with low vitamin D status [25(OH)D less than 50 nmol/L] (both  $p < .005$ ). The frequency of BsmI GG+AG genotype, TaqI TT+CT genotype were significantly higher in women who developed preterm birth compared with those who did not (24.0% vs. 14.1%,  $P = 0.01$ ; 22.7% vs. 14.5%,  $P = 0.04$ ; respectively). The vitamin D receptor gene ApaI, Cdx2, FokI, and Tru91 polymorphisms did not show any difference in patients who developed preterm birth compared with those who did not ( $P > 0.05$ ). After adjusting for potential confounding factors, logistic regression analysis showed that both BsmI GG+AG and TaqI TT+CT genotype were associated with an increased risk of preterm birth (aOR 3.09, 95% CI 1.14 - 8.43; aOR 3.06, 95% CI 1.08-8.67) in only women with low vitamin D status [25(OH)D < 50 nmol/L]. Conclusion: Our findings suggest that maternal vitamin D receptor gene BsmI and TaqI polymorphism may be associated with risk of preterm birth in pregnant women with low vitamin D status.

**Impact of 25-hydroxyvitamin D serum levels in first trimester on subsequent pregnancy outcomes**

**Schneuer FJ\*, Nassar N, Tasevski V, Guilbert C, Ashton AW, Morris JM, Roberts CL (Clinical and Population Perinatal Health Research, Kolling Institute of Medical Research, University of Sydney, Sydney, Australia)**

Background: Low vitamin D levels during pregnancy have been associated with adverse pregnancy outcomes by few studies, and not by others. Method: We measured maternal 25-hydroxyvitamin D [25(OH)D] in first trimester serum samples from 5,109 women with singleton pregnancies. Information on maternal and infant outcomes was obtained through record linkage of laboratory data to birth and hospital data. Pregnancy outcomes included small for gestational age (SGA), preterm birth, preeclampsia, gestational diabetes mellitus, miscarriage and stillbirth. Multivariate logistic regression was conducted to assess the association between low 25(OH)D (<25, <37.5 and <50nmol/L) with each pregnancy outcome and a composite of any severe pregnancy outcomes (SGA<3rd centile, preterm birth<34 weeks, early-onset preeclampsia or stillbirth). Predictive accuracy was assessed. Results: Median (interquartile range) 25(OH)D for the total population was 56.4nmol/L (43.3-69.8). 25(OH)D levels showed significant variation by parity, smoking, weight, season of sampling, country of birth and socio-economic disadvantage. After adjusting for maternal and clinical risk factors, low 25(OH)D levels were not associated with any pregnancy outcome. The area under the Receiver Operating Characteristics curve (AUC) and likelihood ratio (LR) for the composite of severe pregnancy outcomes of 25(OH)D <25nmol/L were 0.51 and 1.44; and for risk factors alone were 0.64 and 2.87, respectively. Adding 25(OH)D information to maternal and clinical risk factors did not improve the ability to predict severe adverse pregnancy outcomes (AUC=0.64; LR=2.32; P=0.39). Conclusions: Low 25(OH)D levels in first trimester are not associated with adverse pregnancy outcomes and do not predict complications any better than maternal and clinical risk factors.

**The association between parity and birthweight in a longitudinal consecutive pregnancy cohort****Hinkle SN\*, Laughon SK, Sjaarda LA, Mendola P, Boghossian N, Yeung E, Albert PS (Eunice Kennedy Shriver National Institute of Child Health and Human Development, Bethesda MD)**

Nulliparity has been associated with lower birthweight; however, most prior studies were cross-sectional, capturing nulliparous women who may not have other children and therefore not fully comparable to multiparous women. Furthermore, studies have not adequately accounted for important confounders that influence birth weight. We used longitudinal medical data from a retrospective hospital-based cohort of 39,579 women with two to six singleton deliveries >37 weeks, from 2002-2010 in Utah. Using nulliparous women as the reference, we calculated sex and gestational age specific birthweight z-scores. The association between parity and birthweight z-score was examined using linear mixed models with a random effect by woman and parity estimated using a piecewise function with a single term estimating the change between 0 and 1 and linear term when parity >1. All models were adjusted for pregnancy specific variables including maternal prepregnancy body mass index (BMI), gestational weight gain (GWG), sociodemographics, smoking and alcohol use, chronic diseases, and pregnancy complications. Among nulliparous women, mean (standard deviation) prepregnancy BMI, GWG, and birthweight z-score were 23.8 (4.8) kg/m<sup>2</sup>, 15.2 (5.8) kg, and 0.00 (1.0), compared to 24.5 (5.4) kg/m<sup>2</sup>, 13.6 (5.7) kg, and 0.21 (1.00) among primiparous women, respectively. Using longitudinal adjusted models, offspring birthweight increased by 0.19 (95% confidence interval (CI): 0.17, 0.20) z-score units from parity 0 to 1 and by 0.04 z-score units (95% CI: 0.03, 0.05) per unit increase in parity >1. Parity is independently associated with birthweight, with the greatest increase observed between first and second born infants of the same mother.

**Preconception air pollution exposures increase the risk of gestational diabetes mellitus**

**Robledo C\*, Mendola P, Yeung E, Sundaram R, Liu D, Ying Q, Sherman S, Lipsky L, Laughon SK**  
**(Eunice Kennedy Shriver National Institute of Child Health and Human Development, Rockville, MD)**

Air pollutants such as particulate matter (PM) and nitrogen dioxide (NO<sub>2</sub>) have been linked to the development of type 2 diabetes, but no studies have examined their impact on the risk of gestational diabetes mellitus (GDM). Singleton pregnancies without pregestational diabetes (n=220,264) from the Consortium on Safe Labor (2002-2008) were linked to pollutant exposures estimated using the Community Multi-scale Air Quality model. Average exposure within the 3-month window prior to pregnancy, defined as 91 days before the last menstrual period, was calculated for PM<sub>2.5</sub>, PM<sub>10</sub>, NO<sub>2</sub>, carbon monoxide (CO), sulfur dioxide (SO<sub>2</sub>) and ozone (O<sub>3</sub>). GDM diagnosis (n=11,347) was ascertained from electronic medical records supplemented by discharge ICD-9 codes. Binary regression models with the log link function were fitted to estimate relative risks (RR) of GDM per 1-unit increase in pollutant concentrations adjusting for study site, maternal age and race. During the 3 months prior to pregnancy, criteria air pollutants, with the exception of ozone, increased the risk for GDM: PM<sub>2.5</sub> (RR=1.03, 95% CI: 1.02, 1.04), PM<sub>10</sub> (RR=1.03, 95% CI: 1.02, 1.04), NO<sub>2</sub> (RR=1.03, 95% CI: 1.02, 1.04), SO<sub>2</sub> (RR=1.09, 95% CI: 1.07, 1.12), CO (RR=1.0014, 95% CI: 1.0009, 1.0019) and O<sub>3</sub> (RR=0.99, 95% CI: 0.99, 1.00). In conclusion, we observed increased risk for GDM with air pollutants previously shown to be associated with type 2 diabetes (PM and NO<sub>2</sub>) and with other criteria air pollutants. Preconception may be a key exposure window with respect to the association between air quality and glucose intolerance during pregnancy.

**Temperature and neonatal mortality in California, 1999-2007****Basu R\*, Sie L****(California Environmental Protection Agency, Office of Environmental Hazard Assessment, Oakland CA)**

Temperature and mortality has been widely researched, although most studies have focused on the elderly. Infants have been less studied but also lack appropriate thermoregulatory response to heat exposure. Our objective was to examine the association between mean daily apparent temperature, a combination of temperature and humidity, and neonatal mortality. Neonates were defined as infants from the time of birth up to 28 days following birth. We applied the time-stratified case-crossover study design to neonatal deaths reported by the California Vital Records occurring during the warm season of May through October from 1999 through 2007. The study population included 6,564 cases residing within twenty kilometers of meteorologic monitors. We considered the effects by region, disease subgroup, race/ethnicity, and potential confounding by air pollutants. Coastal areas were more impacted than non-coastal areas for most disease subgroups for same-day apparent temperature (excess risk 7.12% per 10°F apparent temperature (95% confidence interval [CI]: -9.82, 24.34) all-cause mortality in coastal areas). The most notable significant positive association was found for circulatory causes in coastal areas (234.52%; 46.25, 456.66), while respiratory diseases and short gestation duration also had positive impacts. For all-cause mortality, temperature effects appeared to be greatest for Blacks (11.06%; -3.44, 25.77), although risk varied by race/ethnicity and disease subgroup. Asian neonates, for example, had a significant association with deaths from respiratory causes (136.69%; 19.43, 267.44). Risks remained independent of air pollutants. Elevated temperatures were found to have effects on neonatal mortality for several outcomes. Region and race/ethnicity modified the association.

**Risk factors associated with trajectories of mothers' depressive symptoms across the postnatal and early parenting period: An Australian population based longitudinal study****Giallo R\*<sup>1,2</sup>, Cooklin A<sup>1</sup>, Nicholson, JM<sup>1,2</sup>****(<sup>1</sup>Parenting Research Centre, Australia; <sup>2</sup>Murdoch Childrens Research Institute, Australia)**

Background: Women are at increased risk of depressive symptoms in the first year postpartum. Few studies have examined the course, persistence and associated risk factors of depressive symptoms beyond this time. The aims of the study were to: (a) report on the course of depressive symptoms over the early parenting period (6-7 years postpartum) for a nationally representative sample of Australian women, (b) identify classes of women defined by their trajectory of symptoms over time, and (c) identify antenatal and early postnatal risk factors associated with persistent symptoms. Methods: Data from 4879 women participating in the Longitudinal Study of Australian Children were analysed. Latent growth class analysis was conducted to identify classes defined by distinct trajectories of depressive symptoms, and logistic regression conducted to identify risk factors associated with class membership. Results: For the overall sample, depressive symptoms were highest during the first year postpartum and then gradually decreased across the early parenting period. Two distinct classes were identified with the majority of women (84%) reporting minimal depressive symptoms over time, and 16% experiencing persistently high symptoms. Early risk factors for persistent depressive symptoms were younger maternal age, being from a non-English speaking background, not completing high school, having a past history of depression, antidepressant use during pregnancy, child development problems, lower parental self-efficacy, poor relationship quality and more stressful life events. Conclusion: A better understanding of the early risk factors associated with persistent depressive symptoms can inform approaches to the early identification and treatment for women at risk.

**Changes in diabetes status between pregnancies and impact on newborn outcomes**

**Boghossian N\*, Yeung E, Mendola P, Laughon S, Hinkle S, Zhang C, Albert P  
(Eunice Kennedy Shriver National Institute of Child Health and Human Development,  
Rockville, MD)**

Pregnancies complicated by gestational (GDM) or preexisting diabetes mellitus (DM) are at high risk for adverse newborn outcomes. The impact of GDM history, recurrence, or progression to DM on newborn risk is unknown. Medical record data on 62,013 repeat pregnancies were collected retrospectively from women who delivered at least 2 pregnancies in Utah (2002-2010). Poisson regression models with robust variance estimators were used to estimate relative risks (RR) of large for gestational age (LGA), preterm birth (<37 wks) and respiratory distress syndrome (RDS) adjusting for study site, maternal age, race, parity, prepregnancy BMI and smoking status. Compared to women with no previous GDM, GDM in the previous pregnancy but not in the current one increased the risk of LGA [RR=1.2, 95% confidence interval (CI)=1.1, 1.4] and preterm birth (RR=1.2; 95%CI=1.0, 1.5). Risk estimates were higher for recurrent GDM [LGA (RR=1.7; 95%CI: 1.5, 1.9); preterm birth (RR=1.7; 95%CI: 1.4, 2.0)] than pregnancies with current GDM only [LGA (RR=1.4; 95%CI: 1.3, 1.6); preterm birth: (RR=1.4; 95%CI: 1.2, 1.6)]. Women with a previous GDM that progressed to DM in the current pregnancy had increased risks of LGA (RR=2.0, 95%CI: 1.7, 2.4), preterm birth (RR=1.8, 95%CI: 1.4, 2.3), and RDS (1.7, 95%CI: 1.1, 2.6) compared to women with no previous GDM and no current DM. GDM in a previous pregnancy alone without recurrence may still confer an increased risk for LGA and preterm birth. Pregnancies complicated by GDM that progress to DM have the highest risks of adverse newborn outcomes.

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**Sleep disorders and hypertension in pregnant and non-pregnant women of childbearing age**

**Xiong X\*, Xie Y, Buekens P**

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The authors sought to examine the association between sleep disorders and hypertension in pregnant and non-pregnant women. We conducted a secondary analysis based on self-reported health and sleep characteristics collected by the National Health and Nutrition Examination Survey (NHANES) from 2005 to 2010. The present study sample included 507 pregnant women and 3,875 non-pregnant women aged 15-44 years. Univariate and multivariate logistic analyses were performed to examine the association between sleep disorders and hypertension and to adjust for age, ethnicity, smoking, body mass index, and other confounding variables. The overall prevalence of having trouble sleeping, sleep disorders (e.g., sleep apnea and insomnia), and daily sleep < 7 hours was 23.5%, 7.0%, and 29.0% in pregnant women; and 21.9%, 6.7%, and 37.7% in non-pregnant women. In pregnant women, women who had trouble sleeping, sleep disorders, and daily sleep < 7 hours were at increased risk of having hypertension, with adjusted odds ratio (aOR) of 2.5 [95% confidence interval (CI): 1.0-6.3], 4.6 (1.4-14.7), and 1.09 (0.5-2.5), respectively. In non-pregnant women, women who had trouble sleeping, sleep disorders, and daily sleep < 7 hours were also at increased risk of having hypertension, with aOR of 2.9 (2.2-3.8), 4.1 (2.5-6.7), and 1.6 (1.2-1.9), respectively. The authors conclude that sleep disorders are associated with an increased risk of hypertension in both pregnant and non-pregnant women of childbearing age.

**Pre-pregnancy body mass index, gestational weight gain and depression among pregnant Hispanic women****Ertel K, Silveira M\*, Pekow P, Markenson G, Dole N, Chasan-Taber L  
(University of Massachusetts, Amherst, MA)**

Research has demonstrated a positive association between obesity and depression. However, studies examining this association among pregnant women are sparse and predominantly in non-Hispanic women. We examined the relation between pre-pregnancy body mass index (BMI) and prenatal depression, and tested if gestational weight gain (GWG) modified this association among 1090 pregnant Hispanic women from Proyecto Buena Salud (2006-2011), a prospective cohort study conducted in Massachusetts. The Edinburgh Postnatal Depression Scale was administered during early (mean=12.3 weeks gestation), mid- (mean=21.3 weeks gestation), and late (mean=30.6 weeks gestation) pregnancy. Scores  $\geq 15$  were considered probable major depression and  $\geq 13$  were considered at least minor depression. Information on pre-pregnancy BMI (kg/m<sup>2</sup>) and GWG were abstracted from medical records. We used longitudinal, generalized linear mixed effects models to calculate the association between pre-pregnancy BMI and depression across pregnancy. Approximately 45% of women were overweight or obese prior to pregnancy, 24% reported major depression, and 33% reported minor depression at one or more times during pregnancy. Women who were overweight (25-<30 kg/m<sup>2</sup>) were less likely to experience probable major depression (Odds Ratio (OR)=0.51; 95% Confidence Interval (CI) 0.28-0.91) and minor depression across pregnancy (OR=0.53, 95% CI 0.31-0.90) as compared to normal weight women, when adjusted for sociodemographic and acculturation factors. Obese women ( $\geq 30$  kg/m<sup>2</sup>), and underweight women (<18.5 kg/m<sup>2</sup>) did not have an increased risk of depression. GWG did not modify the effect of BMI on depression. Findings suggest an inverse association between overweight and risk of depression during pregnancy in this sample of predominantly Puerto Rican women.

**Air pollution and cardiovascular events during labor and delivery**

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**(Eunice Kennedy Shriver National Institute of Child Health and Human Development,**  
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Short-term exposure to air pollution is associated with increased risk of cardiovascular disease (CVD) events in the general population, but whether pregnant women are vulnerable is unknown. We studied this association in 223,502 singleton deliveries in the Consortium on Safe Labor (2002-2008). Average daily air pollution exposure for the 24 hours prior to delivery admission (time 0) and for 7 days prior to delivery (to evaluate less acute effects) were obtained from regional three-dimensional air quality simulations using the Community Multiscale Air Quality model. Total CVD events (myocardial infarcts, cardiac arrests/failures, strokes, and unspecified events) were ascertained from hospital discharge records. Logistic regression with robust standard errors estimated the odds ratios (ORs) of CVD events with one-unit increase in the daily mean of air pollutant at each time point, adjusting for site, age, race/ethnicity, insurance status, smoking and pre-pregnancy body-mass index. A total of 687 (0.3%) CVD events were identified. Exposure to nitrate particles increased CVD events with 5- and 6-day lags (OR=1.06, 95% confidence interval [95%CI]=1.01-1.11). CVD events also increased after 5-day lag exposure to dust particles (OR=1.05, 95%CI=1.01-1.09), nitrogen oxides (OR=1.02, 95%CI=1.01-1.04) and sulfur dioxide (OR=1.05, 95%CI=1.02-1.09). No association was seen between CVD events and total particle matter <2.5 um, organic carbon, ammonium or sulfate particles. In conclusion, exposure to dust, nitrates, nitrogen oxides, and sulfur dioxides increased the risk of CVD events with lags of 5 to 6 days, suggesting oxidative stress or inflammation as potential mechanisms precipitating CVD events with the stress of labor/delivery.

**Low birth weight babies are more often smokers as adults**

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**BACKGROUND:** Low birth weight has been postulated to be a cause of, through early programming, cardiovascular disease in adult life. We suggest that low birth weight also is a marker for maternal smoking during pregnancy, and that these smoking habits will be passed on to next generation. **OBJECTIVE:** The aim was to study whether there is a higher prevalence of adult daily smoking among men and women born with low rather than normal birth weight. **MATERIAL AND METHODS:** We used data from the Medical Birth Registry of Norway (MBRN), which has national coverage of all births since 1967. We studied birth weight of term, singleton women (n=172 509) and men (n=130 927) in 1967-1995, and linked these to their own infants delivered in 1999-2010, where maternal smoking habits during pregnancy were registered. Z-score of birth weight by gestational age in the first generation was exposure and maternal smoking habits of the adult women or the partners of the adult men were outcomes. **RESULTS:** 20 % of mothers with Z-score -3.5 were daily smokers, compared to 8 % of women with Z-score 1.5 (RR 2.45 (95 % C.I. 1.73 - 3.47)). 15 % of fathers with Z-score -3.5 had a daily smoking partner, compared to 9 % of fathers with a 1.5 Z-score (RR 1.72 (95 % C.I. 1.02 - 2.92)). The relation persisted when stratifying by grandmothers' education (mothers of the first generation infants). **CONCLUSION:** Our findings indicate that being born low birth weight is associated with smoking in adulthood.

**Outcomes following waterbirth: The MANA Statistics Project****Bovbjerg ML\*, Cheyney MJ, Everson CL  
(Oregon State University, College of Public Health and Human Sciences)**

The FDA, citing lack of safety evidence, is holding hearings to determine whether birth tubs should be Regulated Medical Devices. We compared outcomes for (i)waterbirths, defined as babies born under water; (ii)non-waterbirths; and (iii)intended, but not completed, waterbirths. Data are from the Midwives Alliance of North America Statistics Project (MANA Stats), collected from medical records between 2004-2009. We report on n=18,434 babies, whose n=18,379 mothers delivered with a midwife at home or in a birth center. Results are reported as Odds Ratio (95% Confidence Limits); non-waterbirth babies(ii) are the reference group. All analyses controlled for primiparity. Newborns born underwater(i) fared the best, whereas newborns whose mothers intended for them to be born underwater, but were not(iii), fared the worst: NICU admission [0.59 (0.52, 0.67) versus 1.17 (1.11, 1.23)]; low 5-minute Apgar [0.82 (0.77, 0.87) versus 1.92 (1.53, 2.42)]; meconium aspiration [0.55 (0.52, 0.58) versus 1.23 (1.20, 1.27)]; perinatal death [0.41 (0.13, 1.27) versus 2.06 (0.91, 4.67)]; neonatal death [0.72 (0.49, 1.06) versus 2.08 (0.80, 5.44)]. However, waterbirth(i) increased the odds of perineal trauma for mothers: 1.12 (1.11, 1.12); though mothers in the intended(iii) category fared even worse: 1.68 (1.58, 1.78). The 'intended' exposure category in our data is likely a marker for labor and delivery complications: if the labor was not going as expected, the attending midwife asked the mother to discontinue water immersion. We conclude that being born underwater confers no additional risk to the newborn, but adds additional risk of trauma to the mother.

**Influence of CYP2A6 \*4 genotypes on serum cotinine among non-smoking Chinese pregnant women: implication for secondhand smoke measurement**

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Objective: To investigate the influence of CYP2A6\*4 genotypes on serum cotinine among non-smoking pregnant women and assessed its implication for measuring secondhand smoke (SHS) exposure during pregnancy. Methods: We analyzed 545 Chinese non-smoking pregnant women enrolled in a case-control study on SHS and birth outcomes in Guangdong, Southern China. Participants self-reported their SHS exposure status and duration during pregnancy in hospital for delivery. PCR was used for CYP2A6\*4 genotyping, and ELISA for measuring serum cotinine. We stratified women by their self-reported SHS exposure status and CYP2A6\*4 genotypes, and then compared their median concentration of serum cotinine among women with Kruskal-Wallis and Nemenyi tests. Results: In our sample, 16.3% of pregnant women had CYP2A6\*4 allele; and the genotype frequencies of CYP2A6\*1/\*1, CYP2A6\*1/\*4 and CYP2A6\*4/\*4 were 69.7%, 27.9% and 2.4%, respectively. Among women who self-reported non-SHS exposure, the median cotinine levels were 2.83, 1.39 and 0.77 ng/ml for those with CYP2A6\*1/\*1, CYP2A6\*1/\*4 and CYP2A6\*4/\*4 genotype, respectively. Among women who self-reported SHS exposure, the median cotinine levels were 3.32, 2.37 and 1.56 ng/ml for those with CYP2A6\*1/\*1, CYP2A6\*1/\*4 and CYP2A6\*4/\*4 genotype, respectively. Strikingly, self-reported SHS exposed women with CYP2A6\*1/\*4 or CYP2A6\*4/\*4 genotype had significantly lower (rather than higher) median cotinine level than self-reported non-SHS exposed women with CYP2A6\*1/\*1 (P-value, 0.012). Conclusion: In our sample, CYP2A6\*4 genotype was associated with lower serum cotinine among non-smoking pregnant women. Measuring CYP2A6\*4 genotype may help to improve the validity of SHS measure by serum cotinine among pregnancy women.

**The optimal measurement for secondhand smoke exposure among Chinese pregnant women**

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**Objective:** To combine maternal self-report and serum cotinine along with CYP2A6 genotypes to explore the optimal measurement for secondhand smoke (SHS) exposure during pregnancy.

**Methods:** We analyzed the data from 545 Chinese pregnant women in Guangdong, Southern China. Pregnant women self-reported SHS exposure status and duration at the delivery visit. PCR was used for CYP2A6\*4 genotyping and ELISA for measuring serum cotinine. Area under ROC curve (AUROC) and Hosmer-Lemeshow test (H-L test) was used to assess the predictive ability of different SHS measurements for small-for-gestational-age birth. **Results:** For self-report only, daily SHS exposure for 15 minutes or longer had higher predictive ability for risk of SGA (adjusted odds ratio [OR], 1.79 [95% confidence interval 1.08, 2.98]; AUROC, 0.639) than other SHS definitions based on ever exposure or weekly exposure for 15 minutes or longer (recommended by WHO). For serum cotinine only, the cut-off point 3 ng/ml had the highest predictive ability for risk of SGA (OR, 1.55 [1.02, 2.37]; AUROC, 0.645). For the combinations of self-report and serum cotinine, the definition of SHS exposure positive based on self-reported daily SHS exposure for 15 minutes or longer or serum cotinine 3 ng/ml or higher had highest predictive ability for risk of SGA (OR, 1.54 [1.01, 2.35]; AUROC, 0.648) than other possible combinations, such as modified cut-off points of serum cotinine by CYP2A6 genotypes.

**Conclusion:** In our sample, combining self-reported daily SHS exposure for 15 minutes and serum cotinine 3 ng/ml seemed to be the optimal measurement for SHS exposure during pregnancy.

**Prevalence and correlates of migraine in a cohort of pregnant women in the U.S.****Frederick IO\*, Qiu C, Enquobahrie DA, Aurora SK, Peterlin BL, Gelaye B, Williams MA  
(Center for Perinatal Studies, Swedish Medical Center, Seattle WA)**

Background: Migraine is a common neurological disorder of idiopathic origin, ranked among the world's leading causes of years lived with disability by the World Health Organization. The burden of migraine is highest in women of reproductive age and accumulating evidence suggest associations of migraine with increased risks of adverse perinatal outcomes including preeclampsia, fetal growth restriction and placental abruption. Methods: We characterized the prevalence, symptoms and correlates of migraine and other headaches in a cohort of 500 pregnant women attending prenatal care clinics in the Pacific Northwest. Migraine and other headache disorder were defined using the International Classification of Headache Disorders-II (ICHD-II) criteria. Assessments of headache-related disability before and during pregnancy were assessed using the MIDAS questionnaire. Logistic regression was conducted to estimate odds ratios (OR) and 95% confidence intervals (95% CI) for factors associated with migraine. Results: The lifetime prevalence of migraine was 20.0% (95% CI 16.6-23.8%). When probable migraine was included, the lifetime prevalence of migraine in this population increased to 29.8% (95% CI 25.9-34.0%). An additional 16.6% (95% CI 13.5-20.2%) of the cohort were classified as having non-migraine headaches. Migraine headaches were associated with a family history of headache or migraine (OR=3.40; 95% CI 2.11-5.49), childhood carsickness (OR=7.79; 95% CI 4.37-13.87), pre-pregnancy overweight/obesity status (OR=2.12; 95% CI 1.28-3.49), and a high frequency of fatigue (OR=2.06; 95% CI 1.13-3.76). Approximately 26.2% of migraineurs endorsed moderate or severe headache-related disability during early pregnancy. Conclusion: Migraine and headache-related disability are prevalent conditions among pregnant women.

**Concordance of self-reported migraine with International Classification of Headache Disorders-II Diagnostic Criteria in a cohort of pregnant women****Qiu C\*, Williams MA, Aurora SK, Peterlin BL, Gelaye B, Frederick IO, Enquobahrie DA (Swedish Medical Center, Seattle, WA)**

**OBJECTIVE:** Migraine, a common neurological disorder often associated with autonomic nervous system dysfunction, has emerged as a novel risk factor for adverse perinatal outcomes including hypertensive disorders of pregnancy, preterm birth and placental abruption. Most prior studies have relied on self-report of physician-diagnosed migraine as a means for classifying pregnant women with a history of migraine. No studies have investigated the agreement of self-reported migraine with the International Classification of Headache Disorders, 2nd edition (ICHD-II) diagnostic criteria in pregnancy cohorts. **METHODS:** Self-reported, physician diagnosed migraine was obtained in a sample of 500 women who were also interviewed using a detailed migraine questionnaire that allowed the application of ICHD-II diagnostic criteria. **RESULTS:** Approximately 92% of women self-reporting a physician diagnosis of migraine received the diagnosis between the ages of 11 and 40 years. Some 6.8% of migraineurs received the diagnosis before age 10 years; 38.8% received the diagnosis between 11-20 years; 42.7% between 21-30 years; 10.7% between 31-40 years; and 1.0% at age 40 or older. Approximately 81.6% of women self-reporting a physician diagnosis of migraine fulfilled ICHD-II criteria for migraine (63.1% definitive ICHD-II migraine; 18.5% ICHD-II probable migraine). In conclusion, we found excellent agreement between self-reported migraine and ICHD-II-based migraine classification in this pregnancy cohort. **CONCLUSION:** We demonstrated the feasibility of using questionnaire-based migraine assessment according to the full ICHD-II criteria in epidemiological studies of pregnant women.

**Diagnosis of amniotic fluid infection prior to cerclage using glucose and gram stain: An individual patient meta-analysis****Sabr Y<sup>1,2,3</sup> \*, Lisonkova S<sup>1</sup>, Joseph KS<sup>1,3</sup>****(<sup>1</sup>Department of Obstetrics and Gynaecology, University of British Columbia, Vancouver, BC, Canada, <sup>2</sup>Department of Obstetrics and Gynaecology, College of Medicine, King Saud University, Riyadh, Saudi Arabia <sup>3</sup>School of Population and Public Health, University of British Columbia, Vancouver, BC, Canada)**

Objective Success of a rescue cerclage in the second trimester of pregnancy depends on the absence of subclinical microbial invasion of the amniotic cavity (MIAC). We carried out a study to assess the diagnostic performance of Gram stain and glucose concentration for the detection of subclinical MIAC. Methods We used individual-level information from published studies on amniotic fluid (AF) culture, Grams stain and glucose tests among women with preterm labour. We calculated sensitivity, specificity, and other indices for the Gram stain test, the glucose test (<math>\sim</math>14 mg/dl) and their combination. Logistic regression was performed to estimate the probability of infection using both tests as predictors. Model calibration ability, risk-stratification capacity and classification accuracy were evaluated. Results The rate of culture confirmed MIAC was 11.2% (34 of 288 women). The Gram stain test had a sensitivity of 65% and a specificity of 99%. Testing positive with the Gram stain or glucose tests yielded a sensitivity of 88% and a specificity of 87%. Combining both Gram stain and glucose tests yielded a sensitivity of 62% and a specificity of 100%. Logistic regression showed that the use of both tests provided enhanced calibration ability, risk-stratification capacity and classification accuracy as compared with the use of the Gram stain test alone. Conclusion AF Gram stain combined with glucose testing provides superior performance for the diagnosis of subclinical MIAC as compared with Gram stain testing alone. Diagnostic amniocentesis using these tests should be part of the evaluation of women considering cerclage to prolong pregnancy

**Association of early pregnancy vitamin D with symptoms of antepartum depression and anxiety****Huang J<sup>a</sup>, Qiu C<sup>b</sup>, Miller RS<sup>b</sup>, Williams MA<sup>c</sup>, Enquobahrie DA<sup>a,b</sup>****(<sup>a</sup>Department of Epidemiology, School of Public Health, University of Washington; <sup>b</sup>Center for Perinatal Studies, Swedish Medical Center, Seattle, WA; <sup>c</sup>Department of Epidemiology, School of Public Health, Harvard University)**

Background: While a few recent studies have reported inverse associations of vitamin D with antepartum depression and anxiety, our understanding of inter-relationships and potential modifiers of these prevalent risk factors is tenuous. Methods: We examined associations of maternal early pregnancy (median 15 weeks gestation) 25-hydroxyvitamin D (25[OH]D) with antepartum depression and anxiety symptoms among a pregnancy cohort (N = 498). Serum 25[OH]D concentrations were measured using LC-MS/MS. Depression and anxiety symptoms were evaluated using self-administered DASS-21 (Depression, Anxiety, and Stress Scale-21) and PHQ-9 (Patient Health Questionnaire-9) survey instruments. Regression models were fit to calculate beta estimates and 95% confidence intervals. Effect modification by physical activity was examined. Results: Mean 25[OH]D concentration among participants was 34.4 ng/ml and 40% were vitamin D deficient ( $\leq 32$  ng/ml). 12.4% had moderate depression symptoms and 12.2% had moderate anxiety symptoms. Overall, 25[OH]D concentrations was inversely associated with DASS-21 and PHQ-9 scores: Participants in the highest versus lowest quartile of 25[OH]D had 3.47 and 1.11 lower DASS-21 and PHQ-9 scores, respectively (p-values  $< 0.05$ ). Similarly, each ng/ml higher 25[OH]D concentration was associated with 0.14 and 0.04 lower DASS-21 and PHQ-9 scores (p-values  $< 0.05$ ). These associations were attenuated and statistically insignificant in fully adjusted models. However, observed inverse associations of 25[OH]D with depression symptoms were more pronounced among participants who did not report physical activity during current pregnancy (interaction p-value  $< 0.05$ ). Conclusions: Our study provides modest evidence for inverse associations of early pregnancy maternal vitamin D concentrations and antepartum depression and anxiety and potential modification by physical activity.

**Health behaviors of inactive pregnant women at high risk for gestational diabetes mellitus**

**Nobles C\*, Marcus BH, Stanek E, Markenson G, Chasan-Taber L  
(UMass Amherst, MA)**

Despite evidence associating moderate exercise during pregnancy with reduced risk of gestational diabetes mellitus (GDM), few studies have investigated the health behaviors of inactive pregnant women at high risk for GDM. We evaluated these factors among participants in the Behaviors Affecting Baby and You (B.A.B.Y.) Study (n=309, 2007-2012), a randomized controlled trial conducted among prenatal care patients at high risk for GDM (i.e., personal history of GDM; or body mass index (BMI) >25 kg/m<sup>2</sup> and family history of type 2 diabetes mellitus) and not participating in >30 minutes/day of moderate-intensity activity on most days of the week. Data were collected through self-report at enrollment (mean=12.2-3.3 weeks gestation). The majority of women were young (46.3% < age 25), Hispanic (55.0%), unmarried (65.4%) with low income (37.2% ≤\$15,000/year) and education (24.9% did not graduate high school). A total of 12.6% reported smoking >1 cigarette/day in early pregnancy (with none smoking >10 cigs/day) while only 1.3% reported consuming alcohol in early pregnancy. Mean pre-pregnancy BMI was 33.1±6.6 kg/m<sup>2</sup> (94.8% overweight/obese) and 12.9% had a personal history of GDM. The average MET-hrs/wk in early pregnancy was 49.8-22.7, with the majority expended during household (22.9-14.2 MET-hrs/wk) and occupational (12.1-13.2 MET-hrs/wk) activities and the lowest amount expended during sports/exercise (1.63-1.86 MET-hrs/wk). The majority of this activity was light-intensity (20.3-9.4 MET-hrs/wk) and only 0.2 MET/hrs week (±0.6) was vigorous intensity. Knowledge of demographics and health behaviors of inactive women at high risk for GDM is essential in informing targeted physical activity interventions designed to prevent GDM.

**Appetite, dietary intake, and gestational weight gain**

**Tian F\*, Wen X, Zhang C, Xie C, Lin J, Yuan S, Chen L, Huang B, Guo X, Jia D, Chen W**  
(Department of Biostatistics and Epidemiology, School of Public Health, Sun Yat-sen University, Guangzhou, Guangdong, China)

Objective: To investigate the effect of appetite after 20 gestational weeks and diet on the gestational weight gain (GWG). Methods: We analyzed the data of 3,525 women in the Guangdong Pregnant Women Health Survey conducted during 2009-2010 in Southern China. The pregnant women retrospectively self-reported their appetite (bad, average, and good) after 20 weeks of gestation, and food, beverage, dietary supplement intake during pregnancy. GWG was defined as the difference between self-reported pre-pregnancy weight and measured pre-delivery weight. We fitted multivariable linear regression model for the associations of appetite and dietary intake with GWG, adjusting for family income, maternal age, education, occupation, marital status, pre-pregnancy body mass index, physical activity during pregnancy, and the gender of child and gestational age. Results: In univariate analyses, higher intake of egg, bean, milk, fish, vegetable was associated with higher GWG (P-value<0.05). Maternal better appetite after 20 weeks of gestation (good vs. bad, 1.62 kg [95% confidence interval, 0.90 to 2.34]), calcium supplement use (ever vs. never, 0.67 kg [0.27 to 1.08]), egg intake (2-4 per day vs. <2 per day, 0.79 kg [0.35 to 1.24]), beans intake (100g-200g per day vs. never, 0.70 kg [0.09 to 1.31]) was associated with higher GWG. In contrast, maternal tea drinking during pregnancy (ever vs. never, -0.67 kg [-1.15 to -0.18]) was associated with lower GWG. Conclusion: Better appetite, calcium supplement, and egg intake might increase GWG, whereas tea drinking might restrict GWG. Our findings can inform dietary intervention to achieve healthy GWG.

**Appetite, dietary intake, and small-for-gestational-age**

**Tian F\*, Wen X, Zhang C, Xie C, Lin J, Yuan S, Chen L, Huang B, Guo X, Jia D, Chen W (Department of Biostatistics and Epidemiology, School of Public Health, Sun Yat-sen University, Guangzhou, Guangdong, China)**

**Objective:** To investigate the effect of appetite after 20 gestational weeks and diet during pregnancy on risk of small-for-gestational-age (SGA). **Methods:** We analyzed the data of 3,525 women in Guangdong Pregnant Women Health Survey, in Southern China, 2009-2010. The women retrospectively self-reported appetite (bad, average, and good) after 20 gestational weeks, and diet during pregnancy. We defined SGA as birth weight below tenth percentile by gender and gestational age within a reference population of Asian newborns. We fitted Logistic regression model for the associations of appetite and diet with SGA, adjusting for family income, maternal age, education, occupation, marital status, pre-pregnancy body mass index, and physical activity during pregnancy. **Results:** Pregnant women with average (odds ratio, 0.71 [95% confidence interval, 0.51 to 0.98]) or good appetite (0.42 [0.30 to 0.60]) after 20 gestational weeks had lower risk for SGA than those with bad appetite. Pregnant women who consumed 100g-200g (0.48 [0.28 to 0.82]) or  $\geq$ 200g (0.51 [0.30 to 0.87]) vegetable per day had lower risk of having SGA newborns than those who consumed  $<$ 100g, and who often consumed fish (0.57 [0.38 to 0.85] for  $\geq$ 200g per day, 0.72 [0.53 to 0.99] for  $<$ 100g) were less likely to have SGA newborns than those did not consume fish. In contrast, pregnant women who consumed  $\geq$ 100g beans (1.30 [1.05 to 1.61]) per day had higher risk for SGA than those who consumed  $<$ 100g. **Conclusion:** Good appetite during later pregnancy, higher intake of vegetable and fish, moderate beans intake might reduce risk of SGA.

**Persistent organochlorines and hypertensive disorders of pregnancy****Savitz D\*, Wellenius G, Klebanoff M, Jensen E, Longnecker M  
(Brown University)**

Little research has considered the role of environmental toxicants in the etiology of preeclampsia, but pathways related to oxidative stress, inflammation, and lipid metabolism may be relevant. We examined the relationship between serum organochlorines, including the DDT metabolite DDE, polychlorinated biphenyls (PCBs), and related compounds and the development of gestational hypertension and preeclampsia. Data from the Collaborative Perinatal Project, a large US birth cohort study conducted in the 1960s with markedly higher exposures than at present, were analyzed. 2,193 women from a previous study had measured third trimester serum organochlorine values (lipid-adjusted) as well as detailed information on blood pressure and proteinuria. There were 211 women with gestational hypertension and 109 with preeclampsia. Logistic regression yielded evidence of inverse associations, with adjusted odds ratios in the uppermost quintile for DDE of 0.7 (95% CI=0.4-1.3) and 0.4 (95% CI=0.1-0.9) for gestational hypertension and preeclampsia with p-values for linear trend of 0.29 and 0.02, respectively. The pattern for total PCBs was as or more notable, with adjusted odds ratios in the uppermost quintile of 0.6 (95% CI=0.3-1.1) and 0.2 (95% CI=0.04-0.8), for gestational hypertension and preeclampsia, with p-values for linear trend of 0.08 and 0.04, respectively. Other organochlorines showed inverse associations that were less pronounced or consistent. There is strong support for an inverse association for both DDE and PCBs and hypertensive disorders of pregnancy. Artifacts related to shared determinants of exposure biomarkers and outcome such as renal dysfunction and dyslipidemia may account for the associations.

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**Risk of spontaneous preterm birth in relation to maternal experiences of serious life events during pregnancy**

**Barrios YV\*, Sanchez SE, Qiu C, Gelaye B, Williams MA  
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Lima, PERU)**

Objective: To examine the risk of spontaneous preterm birth (sPTB) in relation to serious life events experienced during pregnancy in Peruvian women. Methods: This case-control study included 479 sPTB cases and 480 term controls. In-person interviews were conducted to elicit information regarding maternal socio-demographics, lifestyle characteristics, medical and reproductive histories and experience of serious life events. Multivariate logistic regression procedures were used to estimate adjusted odds ratios (aOR) and 95% confidence intervals (CI). Results: Compared to women who did not experience a serious life event during pregnancy, those who experienced the following life events had more than 2-fold increased odds of sPTB; death of first degree relative (aOR=2.10; 95%CI: 1.38-3.20), divorce or separation (aOR=2.09; 95%CI: 1.10-4.00), financial troubles (aOR=2.70; 95%CI: 1.85-3.94), argument with partner (aOR=2.40; 95% CI:1.78-3.17). Women who experienced any serious life events during pregnancy had higher odds of suffering from spontaneous preterm labor (aOR=2.29; 95%CI: 1.65-3.18) or preterm premature rupture of membrane (aOR=2.19; 95%CI: 1.56-3.08), compared to women who did not experience any events. Associations of similar directions and magnitudes were observed for severity of sPTB. The magnitude of associations increased with increased frequency of experiencing serious life events (P-trend <0.001). Conclusion: Experiencing serious life events during pregnancy was associated with increased risk of sPTB among Peruvian women. Interventions aimed at identifying and assisting women who are experiencing serious life events may reduce the risks of sPTB. Future studies should also include objective measures of stress and stress response to better understand the biological underpinnings of these associations.

**Perinatal complications associated with gestational and pregestational diabetes****Wood C\*, D'Abrosca AT, Roach J, Muri JH  
(National Perinatal Information Center)**

The National Perinatal Information Center (NPIC) is a membership organization of perinatal centers throughout the US. The descriptive analysis presented is a profile of the maternal and neonatal complications of mothers with gestation and pregestational diabetes compared to non-diabetic mothers for the period July 1, 2011 through June 30, 2012 and represents a total of 612,360 perinatal events: 301,891 mothers linked to 310,469 neonates. The analysis looks at trend data (2007-Q2,2012) for a subset of hospitals. The data show an overall rate of pregestational and gestational diabetes of 1.3% and 7.1% respectively with a significant upward trend for both over the trend period. Pregestational and gestational mothers were more likely coded as obese than non-diabetic mothers (22.3% and 13.5% vs. 5.3%), be 35 years or older (32.0%, 32.9% vs 18.6%), experience hypertension (13.6% or 5.1% vs. 2.2 %), have a failed induction (8.3%, 7.0% vs. 4.6%) and stay longer. Infants of pregestational and gestational mothers were more likely to be delivered prior to 37 weeks gestation (25.0%,14.3% vs. 10.2%) and be admitted to the special care nursery (37.5%,20.5% vs.12.9%). Preconception counseling and aggressive prenatal management is critical for women with pregestational diabetes. Continuing trends in obesity and the resultant risk of diabetes makes prenatal screening programs for all women critical. Early diagnosis and management of pregnant women who develop gestational diabetes will require close monitoring and education.

**Embryo transfer practices and perinatal outcomes by insurance mandate status****Boulet SL\*, Kissin D, Sunderam M, Zhang Y, Crawford S, Cohen B, McKane P, Bailey M, Jamieson DJ****(Centers for Disease Control and Prevention, Atlanta, GA)**

Currently, 15 states have infertility insurance mandates requiring full or partial coverage of the costs associated with the treatment of infertility, including assisted reproductive technology (ART); information on perinatal outcomes according to state mandate status is limited. Using linked National ART Surveillance System and birth certificate data for 2000-2006, we assessed embryo transfer practices and infant outcomes for a state with an insurance mandate (Massachusetts) and two states without a mandate (Florida and Michigan). We used multivariable log-binomial models to calculate risk ratios for associations between mandate status and elective single embryo transfer (eSET), transfer of >3 embryos, multiple birth, preterm delivery and low birthweight after adjusting for maternal factors and ART treatment characteristics. The proportion of deliveries conceived by ART was higher in the mandate state compared with the non-mandate states (2.5% vs 0.6%); corresponding differences were also noted in multiple birth rates (2.4% vs. 1.6%). The non-mandate states were less likely to perform eSET (0.4% vs 1.2%, adjusted Relative Risk (aRR) 0.32, 95% Confidence Interval (CI) 0.23-0.44) and more likely to transfer >3 embryos (57.8% vs 47.7%, aRR 1.24, 95% CI 1.21-1.27). Lack of an insurance mandate was positively associated with triplet/higher order deliveries (aRR 2.04, 95% CI 1.71-2.42), preterm delivery (aRR 1.29, 95% CI 1.23-1.35), and low birth weight (aRR 1.22, 95% CI 1.09-1.37). Infertility insurance mandates were associated with increased use of eSET and lower risk for adverse perinatal outcomes; however, overall use of ART and frequency of multiple births was higher in the mandate state.

**Variation in obstetric blood transfusion rates in Australian hospitals****Patterson JA\*, Ford JB, Morris JM, Roberts CL****(Kolling Institute of Medical Research, University of Sydney, New South Wales, Australia)**

Background: Obstetric blood transfusion rates differ between hospitals, and it is unclear whether these differences are due to differences in maternal characteristics or hospital practice. This study aims to investigate the contribution of maternal characteristics and hospital practice to the observed variation in obstetric transfusion rates. Methods: Linked birth and hospital discharge data were used to identify births (N=276,825) in hospitals with at least 50 deliveries per annum between 2007-2009 in New South Wales, Australia. To investigate transfusion rates of any blood product, a series of random effects multilevel logistic regression models were fitted, progressively adjusting for maternal, intervention and hospital factors. Results: Overall, the transfusion rate was 1.3% (hospital range 0.3% to 3.7%). Adjusting for maternal characteristics (age, gestation, sociodemographic status, insurance status, parity and medical disorders), reduced the variation between hospitals by 44%, and a further 4% reduction occurred when obstetric interventions (mode of delivery, augmentation, induction, regional analgesia and episiotomy) were taken into account. Inclusion of anaesthesia services and hospital proportion of privately insured patients reduced variation by a further 38%, leaving little remaining variation. Conclusions: Although much of the variation in transfusion rates between hospitals can be accounted for by maternal characteristics, the variation is further explained differences in practice between hospitals. With increasing concern about the best use of a limited blood supply, lessons could be learnt from hospitals with lower transfusion rates.

**Modeling the circadian rhythm of preterm labor onset and preterm premature rupture of membrane in a sample of Peruvian women**

**Luque Fernandez MA\*<sup>1</sup>, Gelaye B<sup>1</sup>, Qiu C<sup>2</sup>, Ananth CV<sup>3,4</sup>, Sanchez SE<sup>5</sup>, Hernandez-Diaz S<sup>1</sup>, Williams MA<sup>1</sup>**

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**Background & Objective:** There are conflicting reports regarding circadian variation in the onset of spontaneous labor (sPTL) and preterm premature rupture of membranes (PPROM) leading to spontaneous preterm births (sPTB). We modeled participant reported time of sPTL and PPRM onset leading to sPTB. **Methods:** We used multiple parametric and non-parametric methods including trigonometric regression and piecewise cubic splines in generalized linear models to model the circadian variation in sPTL and PPRM onset among 476 women with singleton pregnancies in Lima, Peru. Subgroup analyses were performed according to selected maternal and newborn characteristics. **Results:** A statistically significant morning peak was seen among all sPTB and this was similar for births preceded by sPTL or PPRM. A clear aggregation of SPTL and PPRM onset was noted between 6-10am (42% of cases) with a smaller peak between 5-10pm. The patterns of sPTL and PPRM onset were similar across groupings of gestational age at delivery, fetal gender, parity, maternal pre-pregnancy weight, educational attainment and maternal age. **Discussion:** Circadian rhythms modulate physiologic processes and the timing of several medical disorders, including cortisol and oxytocin secretion, myocardial infarction, stroke, and even time of death. The biological rhythm of sPTL and PPRM onset appears to be aligned with the diurnal variation in cortisol secretion. Greater understanding of circadian rhythms in pregnancy and parturition may yield important insights into the pathophysiologic processes underlying the mechanisms of preterm births.

**Perinatal oxidative stress affects fetal ghrelin levels**

**Luo Z\*, Bilodeau JF, Nuyt AM, Fraser WD, Audibert F, Zhao JP, Xiao L, Julien P, Levy E (CHU Sainte-Justine, University of Montreal, Montreal, Canada)**

The prenatal period is considered a critical developmental window in 'programming' the vulnerability to obesity and 'metabolic syndrome' related disorders. The mechanisms remain unclear. Perinatal oxidative stress may affect the expression of certain redox-sensitive gene products and 'program' such susceptibility. This study investigated whether perinatal oxidative stress may affect fetal circulating levels of ghrelin - an important hormone regulating appetite and energy balance. Indices of oxidative stress [F2-isoprostanes, malondialdehyde (MDA)] were measured in maternal (24-28 weeks gestation) and cord blood in 255 singleton pregnancies. Plasma ghrelin concentrations were significantly higher in cord versus maternal blood (median: 392 versus 132 pg/ml), and were strongly positively correlated ( $r=0.50$ ,  $p<0.0001$ ). Indices of oxidative stress were highly correlated in maternal versus fetal cord blood ( $r=0.35$  for MDA,  $r=0.57$  for F2-isoprostanes, all  $p<0.0001$ ). Adjusting for gestational age at blood sampling and cord blood glucose concentration, consistent negative correlations were observed in cord plasma ghrelin levels with indices of oxidative stress in both maternal blood ( $r=-0.37$ ,  $p<0.0001$  for MDA;  $r=-0.17$ ,  $p=0.01$  for F2-isoprostanes) and cord blood ( $r=-0.15$ ,  $p=0.02$  for MDA;  $r=-0.28$ ,  $p<0.0001$  for F2-isoprostanes). Most observed associations remain significant after adjusting for maternal and pregnancy characteristics. The data consistently suggest that perinatal oxidative stress may suppress ghrelin expression during fetal life in humans, which may be a mechanistic link in programming the susceptibility to obesity and metabolic syndrome related disorders.

**Gestational age-dependent association between maternal education/age and preterm birth**

**Auger N \*, Abrahamowicz M, Park AL, Lo E, Wynant W**  
(Institut national de sante publique du Quebec, Montreal, Quebec)

Preterm birth (PTB) before 37 weeks occurs over a wide range of gestational ages, but few studies have assessed time-dependent differences in how risk factors are associated with PTB over the duration of gestation. We sought to evaluate if associations between two major risk factors (maternal education and age) and PTB depend on gestational age at delivery. We estimated hazard ratios of PTB for continuous education and age in a time-to-event analysis using a retrospective cohort of 223,756 live singleton births from the province of Quebec, Canada for the years 2001-2005. Differences in hazards of maternal education and age with PTB were assessed over gestational age in a Cox proportional hazards model using linear and nonlinear time interaction terms, adjusting for maternal characteristics. The associations of PTB with lower (relative to higher) education and older (relative to younger) maternal age strengthened progressively with earlier gestational ages, such that the risk of PTB for maternal education and age was not constant over the course of gestation. Hazard ratios for education (lowest vs. highest), for example, were 1.8 at 36 weeks and 2.5 at 28 weeks (95% confidence intervals 1.7-1.9 and 2.1-3.0, respectively). We conclude that associations of PTB with risk factors such as low education and older maternal age may be stronger very early in gestation. Models that capture the time-dependent nature of PTB may be useful in research aiming to assess associations with risk factors at low gestational ages, so as to avoid masked or biased associations early in gestation.

**Extreme heat and risk of early birth in Montreal, Canada**

**Auger N \*, Park AL, Kosatsky T, Smargiassi A**  
**(Institut national de sante publique du Quebec, Montreal, Quebec)**

The relationship between ambient temperature and birth timing in North America is poorly understood, which is concerning because extreme heat episodes are predicted to increase in the future due to climate change. Evidence suggests that risk of preterm birth is elevated during high heat in sub-tropical areas. The authors evaluated the association of elevated summer temperatures with term and preterm live birth for 203,740 singletons in the city of Montreal, Canada from June through September, 1981-2008. A time-to-event study design with gestational week in the time axis was used. In Cox regression models, hazards of preterm (<37 weeks) and term ( $\geq 37$  weeks) birth were obtained for 1) maximum daily temperature during the six days preceding birth and 2) number of consecutive days with maximum temperature  $\geq 32$  degrees Celsius before birth, adjusted for individual maternal characteristics, air pollution and relative humidity. Maximum temperatures reached  $\geq 32$  degrees for 16,948 births (8.3%). Relative to 20 degrees, the hazard of term birth was 4% higher for maximum temperatures  $\geq 28$  degrees, but no association was found with preterm birth. Extreme heat episodes with 4-6 days of maximum temperatures  $\geq 32$  degrees were associated with a 10% greater hazard of term (but not preterm) birth relative to other days (95% confidence interval 1.0-1.2). We conclude that high ambient temperature and extreme heat episodes may be risk factors for earlier delivery at term. Environmental or medical alerts during high ambient heat should consider including pregnant women at or near term in continental North American areas.

**Estimating the direct effect of preeclampsia on neonatal outcomes independent of preterm delivery using marginal structural models**

**Mendola P\*, Mumford SL, Mannisto T, Holston A, Reddy U, Laughon SK**  
**(Eunice Kennedy Shriver National Institute of Child Health and Human Development, Rockville MD)**

Preeclampsia is characterized by circulating antiangiogenic factors which may increase neonatal risks independent of the risks due to preterm birth (PTB). We used marginal structural models to estimate the controlled direct effect of preeclampsia on neonatal outcomes independent of PTB among 200,381 normotensive and 10,552 preeclamptic singleton pregnancies in the Consortium on Safe Labor (2002-2008). Inverse probability weights were calculated for both preeclampsia and PTB taking into account potential confounders of the preeclampsia-PTB-neonatal outcome pathways including both maternal and neonatal demographic and clinical characteristics. The controlled direct effect of preeclampsia was higher at term than preterm (dichotomized at 37 weeks) for sepsis odds ratio (OR)=1.41 95% confidence interval (1.11-1.79) vs. OR=1.06 (0.94-1.19); transient tachypnea OR=1.44 (1.22-1.69) vs. 1.11 (0.98-1.27); and apnea OR=2.05 (1.48-2.84) vs. 1.50 (1.34-1.67); and lower at term compared to preterm for small for gestational age OR=1.80 (1.66-1.96) vs. OR=3.35 (2.98-3.76). For neonatal outcomes commonly occurring in the preterm period, gestational age was dichotomized at 34 weeks. Controlled direct effects of preeclampsia were also generally higher at 34 weeks or later compared to less than 34 weeks: for respiratory distress syndrome OR=3.35 (2.87-3.89) vs. OR=1.15 (1.01-1.32); and retinopathy of prematurity OR=3.61 (1.43-9.11) vs. 0.90 (0.72-1.13). Preeclampsia was directly associated with many adverse neonatal outcomes beyond morbidity resulting from PTB. While most severe neonatal outcomes were less common at later gestational ages, the controlled direct effect of preeclampsia was often higher among those infants.

**Tipping the scales: Examining the influence of maternal nativity and maternal weight in racial/ethnic disparities in preterm birth**

**Steward K\***

**(Syracuse University, Syracuse, NY)**

Poor birth outcomes among Black women are a persistent problem contributing to racial and nativity disparities in health in the United States. Black women are more likely than both White women and foreign-born Black women to experience adverse birth outcomes such as infant mortality, low birth weight, and preterm birth (David and Collins 2007; Frisbie et al. 2004; Wise 2002; Rosenthal and Lobel 2011; Mason et al. 2011; Lu and Halfon 2003; Cabral et al. 1990). Obesity presents a risk for adverse birth outcomes, but minimal research has been conducted to examine the contribution of obesity or maternal weight, more broadly, to either racial or nativity disparities in birth outcomes. This study examines the impact of maternal weight on the likelihood of preterm birth among Black women. In this research I use data from the 2004-2010 New York Statewide Perinatal Data System to determine the likelihood of preterm birth among U.S.-born Black women compared to foreign-born Black women using. I find that foreign-born Black women who are also overweight are at an increased likelihood of experiencing preterm birth compared to U.S.-born, normal weight women. This research broadens our understanding of the complex nature in which nativity and maternal weight interact to impact the likelihood of preterm birth among Black women.

**Small for gestational age birth and maternal antioxidant levels****Cohen JM\*, Kramer MS, Kahn SR****(Department of Epidemiology, Biostatistics, and Occupational Health, McGill University, Montreal, QC, Canada)**

Background: Oxidative stress may be involved in the pathological process leading to a small for gestational age (SGA) birth. It is unknown, however, whether maternal antioxidant levels are systematically different among pregnancies resulting in SGA birth. Objective: To assess whether maternal antioxidant levels in mid-pregnancy are associated with risk of SGA. Methods: We conducted a case-control study nested within a large multicenter cohort of pregnant women in Montreal. Blood samples were obtained at 24-26 weeks gestation and assayed for antioxidant levels among non-preeclamptic cases of SGA (birth weight <10th percentile for gestational age) birth at term (n=324) and randomly selected controls with birth weight between the 25th and 75th percentiles (n=671). We conducted logistic regression analyses using the z-score of each antioxidant (or its log-transformation, if the distribution was positively skewed) after pooling highly correlated and structurally similar antioxidants. We adjusted for age, body mass index, height, parity, smoking, maternal education, family income, cohabitation, and asthma history. Results: Retinol was positively associated with the risk of SGA; adjusted OR 1.48 (95% CI: 1.27 - 1.75) per 1-SD increase. Carotenoids (log of the sum of b-carotene, lutein/zeaxanthin, a- and b-cryptoxanthin) were protective; adjusted OR 0.60 (95% CI: 0.49 - 0.73). We found no significant effect for a-tocopherol, corrected a-tocopherol (per mmol/l cholesterol), g-tocopherol or lycopene. Conclusions: Elevated retinol may be associated with an increased risk of SGA birth, whereas elevated carotenoid levels may reduce the risk. If confirmed in future studies, nutritional interventions may provide a potential strategy to prevent SGA birth.

**County-level environmental quality is differentially associated with individual- and county-level infant mortality by race****Jagai JS\*, Messer LC, Rappazzo KM, Lobdell DT  
(U.S. Environmental Protection Agency, Research Triangle Park, NC)**

Human health is affected by simultaneous exposure to stressors and amenities, but research typically considers single exposures. In order to account for multiple ambient environmental conditions, we constructed an Environmental Quality Index (EQI) using principle components analysis with data representing five environmental domains (air, water, land, built and sociodemographic). Using U.S. linked births/infant deaths data for 2002 (4,027,479 birth records; 27,527 infant deaths), we report on associations between domain-specific and the overall EQI indices and infant mortality (IM). Results differed by racial group and environmental domain. Race-stratified county-level linear regression analyses (n=3141 counties) demonstrated residence in a county with poor environmental quality (4th quartile) compared to the best quality (1st quartile) was associated with IM among blacks (prevalence difference [PD](95% confidence interval [CI])=0.003(0.004,0.0016). This association was not observed in individual-level analysis using fixed slope, random intercept multilevel logistic models (odds ratio [OR](95% CI)=0.96(0.86,1.05)). This association was not observed among whites in either analysis. The air index demonstrated a strong association among blacks in county-level analyses; increasing quartiles of the air index were associated with PDs for IM (e.g., 4th quartile PD=0.014(0.011,0.017) compared with 1st quartile). The land, water, built and sociodemographic indices had mixed results with IM for both county- and individual-level analyses. This work considered associations both with cases and rates of IM and these environments appear linked to both individual- and county-level outcomes though the associations varied by race group. (This abstract does not necessarily reflect EPA policy.)

**Unexplained variation in hospital cesarean section rates**

**Lee YY, Patterson J, Ford, JB, Nicholl M, Morris JM, Simpson J, Roberts CL\***  
(University of Sydney, New South Wales, Australia)

International concern over rising cesarean rates has focused attention on initiatives to reverse this trend. We assessed variation in cesarean rates among hospitals to identify potential targets for intervention. This is a population-based, record linkage study of 183,310 deliveries in 81 hospitals in New South Wales, Australia, 2009-2010. The Robson classification was used to categorize deliveries into 10 risk-based groups based on parity, plurality, labor onset, previous cesarean, fetal presentation and gestation. Multilevel logistic regression was used to examine variation in hospital cesarean rates within Robson groups, adjusted for differences in maternal age, ethnicity, smoking, diabetes, hypertension and type of maternity care. The 20th centile ('best practice rate') of the risk-adjusted rates was used to quantify the potential impact on the overall cesarean rate of reducing practice variation. The overall cesarean rate was 30.9%, ranging from 11.8% to 47.4% across hospitals. Previous cesarean (36.4% of all cesareans) and nulliparous term births (elective 23.4% and spontaneous 11.1%) were the greatest contributors to the overall rate. After adjustment, marked unexplained variation in hospital cesarean rates persisted for: nulliparous women at term, previous cesarean, multiple pregnancies and preterm births. If variation in practice was reduced by achieving the 'best practice' rate for these risk-based groups, this would lower the overall cesarean rate by 3.1%. Understanding the extent of hospital heterogeneity in cesarean practice and implementing evidence-based practices may result in improved maternity care. We have identified five risk-based groups as priority targets for reducing practice variation and cesarean births.

**Incidence of pre-eclampsia: Risk factors and outcomes associated with early-onset versus late-onset disease****Lisonkova S\*, Joseph KS  
(University of British Columbia, Vancouver, BC, Canada)**

Background: The incidence of early-onset (<34 weeks) and late-onset preeclampsia (PE,  $\geq 34$  weeks) has not been quantified. We examined the gestational-age specific incidence of PE, and identified the associated risk factors and birth outcomes. Methods: All singleton births in Washington State, USA, 2003-2008 (N=456,668) were included and PE onset was determined from hospital records linked to birth certificates. Cox and logistic regression models were used to obtain adjusted hazard ratios (AHR) and odds ratios (AOR) for risk factors and birth outcomes, respectively. Results: The overall PE rate was 3.1% and incidence increased sharply with gestation; early- and late-onset PE rates were 3.8 and 27.2 per 1000 ongoing pregnancies, respectively. Among women with early-onset PE, 12% delivered at  $\geq 34$  week gestation. Risk factors common to both diseases included older maternal age, unmarried status, race, and male fetus, while smoking was protective. Additionally, early-onset PE was strongly associated with diabetes mellitus, primiparity, African-American race, and younger maternal age, whereas late-onset PE was associated with chronic hypertension and congenital anomalies. Early- but not late-onset PE conferred a high risk of fetal death (AOR=5.8, 95% CI 4.0-8.3 vs AOR=1.3, 95% CI 0.8-2.0, respectively). The AOR for perinatal death/severe neonatal morbidity was 16.4 (95% CI 14.5-18.6) in early-onset and 2.0 (95% CI 1.8-2.3) in late-onset PE. Conclusion: Early- and late-onset PE share some etiologic features, differ with regard to several risk factors, and lead to substantially different outcomes. Epidemiologic studies should treat the two PE types as distinct entities from an etiologic and prognostic standpoint.

**Antidepressant use near delivery increases the risk of postpartum hemorrhage**

**Palmsten K\*, Hernandez-Diaz S, Huybrechts KF, Williams PL, Michels KB, Achtyes ED, Mogun H, Setoguchi S**  
(Department of Epidemiology, Harvard School of Public Health, Boston, Massachusetts)

Serotonin reuptake inhibitor (SRI) antidepressant use is associated with increased risk of gastrointestinal bleeding due to antiplatelet effects. It is unclear whether SRI use during pregnancy increases the risk for postpartum hemorrhage (PPH). Using 2000-2007 US Medicaid healthcare data, we identified 106,000 pregnant women with mood/anxiety disorder diagnoses. Women were categorized into four mutually exclusive groups using pharmacy records: current (delivery date), recent (1-30 days before delivery), past (1-5 months before delivery) and no exposure to antidepressants. We compared PPH risk by timing of exposure and by antidepressant class and type. Relative risks (RR), risk differences, and 95% confidence intervals (CIs) were adjusted for PPH risk factors, mood/anxiety disorder severity, and other medications. PPH risk was 2.8% among women with mood/anxiety disorders but no antidepressant exposure. Compared to no exposure, women with current SRI exposure had a 1.47-fold increased risk for PPH (CI: 1.33-1.62) and an excess risk of 1.26% (CI: 0.90-1.62). The RR for recent SRI exposure was 1.19 (CI: 1.03-1.38) and was 0.93 (CI: 0.82-1.06) for past SRI exposure. The current non-SRI group had a 1.39-fold increased risk (CI: 1.07-1.81). Current selective serotonin reuptake inhibitor (SSRI) monotherapy was associated with PPH (RR: 1.41, CI: 1.27-1.56), as was current serotonin-norepinephrine reuptake inhibitor (SNRI) (RR: 2.09, CI: 1.57-2.78) and tricyclic monotherapy (RR: 1.85, CI: 1.06-3.26). Current exposure to specific SSRIs and venlafaxine were significantly associated with PPH. Exposure to SRIs and non-SRIs, including SSRIs, SNRIs and tricyclics, near delivery was associated with a 1.4 to 2.1-fold increased risk for PPH.

**Early-term births: Pathology or natural variability of length of gestation?****Basso O\*****(McGill University, Canada)**

Babies born at 37-38 weeks (early-term) have worse outcomes than those born at 39-41 weeks (full-term). A recently proposed classification of preterm birth included the suggestion that all births before 39 completed weeks be considered preterm (Kramer et al, Villar et al, Goldenberg et al, 2012). In 2006, early-term births comprised 29% of all singleton US births, up from 22% in 1995 (Reddy et al, 2011). A substantial fraction of early-term births may, however, result from the natural variability of gestational length, the magnitude of which we ignore. Simple simulation show that, if natural duration of gestation follows a normal distribution, small differences in parameters can lead to large variations in the proportion of early-term babies. With a mean of 280 days, 17%, 21%, and 23% of pregnancies would naturally end at 37-38 weeks, depending on whether the standard deviation is 8, 10, or 12 days, respectively. The corresponding proportions with a mean of 278 days are 24%, 26%, and 28%. Simulated scenarios will be presented to illustrate how a substantial share of the excess mortality seen in early-term births could be due to a minority of pathological babies whose mortality risk was increased by the factors that caused early birth. Given that we do not know the degree of natural variability of gestational length, inclusion of early-term babies in the preterm category should be carefully considered, as it may result in classifying as 'abnormal' an overwhelming majority of births that are not caused by any pathology.

**Gestational weight gain and risk of preterm birth sub-types**

**Hedderson MM\*, Xu F, Ferrara A**  
**(Kaiser Permanente, Division of Research, Oakland, CA)**

Evidence suggests there are at least two etiologically distinct sub-types of preterm birth, spontaneous preterm births (sPTB) that follow spontaneous labor and premature rupture of membranes and medically indicated preterm birth (mPTB) for maternal or fetal indications, where labor is induced or delivered via cesarean section. The role of gestational weight gain (GWG) in the risk of preterm birth sub-types is unclear. We examined rate of total GWG according to the IOM recommendations (reference group=met recommendations) in relation to preterm birth sub-types in a large multiethnic cohort of 11,808 women who were members of Kaiser Permanente Northern California (KPNC), completed a survey in 2007 and had a subsequent live birth in KPNC between 2007 and 2012. Overall, 6.4% delivered before 37 weeks' gestation, 297 (2.5%) were sPTB, 107 (0.9%) were mPTB and 296 (3.9%) had indications of both sPTB and mPTB; 0.5% were excluded due to lack of information. After adjusting for race-ethnicity, BMI, age and parity, gaining below the IOM recommendations was associated with a significant increased risk of sPTB (OR: 1.5: 95% 1.1-2.2), and with a suggestive increased risk of mPTB (OR: 1.8: 0.9-3.8) and both types (OR: 1.3: 95% CI: 0.9-2.0). Whereas, exceeding the IOM recommendations was associated with a significant decreased risk of sPTB (OR: 0.78: 95% CI: 0.58-1.0), a significant increased risk of medically indicated (1.9 OR: 1.1-3.4), but not with both types (OR: 0.97 (95% CI: 0.7-1.3). Our findings suggest the association between GWG and risk of preterm birth varies by the etiologic sub-type.

**Gentrification and preterm birth in New York City, 2005-2007**

**Huynh M\*, Maroko AR**  
(Lehman College, City University of New York)

Adverse birth outcomes have been linked to neighborhood level socioeconomic status. However, little work has examined the impact of social and economic change over time (i.e. gentrification) on health. This study aims to assess the association between gentrification and preterm birth (PTB) while examining the modifying effect of maternal race/ethnicity and educational attainment. New York City births, 2005-2007, (n=198,666) were linked to a measure of gentrification at the community district level (n=59). The gentrification measure was calculated using percent change in education level, poverty level, and median household income (MHI) between the 2005-2009 American Community Survey and the 1990 Census. PTB was defined as clinical gestational age less than 37 weeks. Generalized estimating equations were utilized to adjust for correlation between clusters. Overall, gentrification (i.e. increase in residents with a college education, increase in MHI, and decrease in residents living below the poverty line) was marginally associated with PTB. However, among Non-Hispanic Blacks, high gentrification was adversely associated with PTB (AOR: 1.17 95% CI 1.07-1.28). Additionally, the likelihood of PTB was increased for women with some college (AOR: 1.2 95% CI 1.11-1.30) and those with a college or more education (AOR: 1.09 95% CI 1.00-1.18) who lived in a high gentrification neighborhood as compared to their counterparts who lived in a low gentrification neighborhood. Although there is a need to develop a more nuanced measure of gentrification, these results indicate that changes in the social and economic character of a neighborhood may have a significant impact on birth outcomes.

**Do trends in maternal and fetal characteristics explain the sharp rise in preterm deliveries in Puerto Rico from 1995 - 2006?****Gibbs CM\*, Hogue CJR****(Department of Epidemiology, Rollins School of Public Health, Emory University)**

Background: Preterm births (<37 weeks' gestation) recently rose steeply in Puerto Rico, from 12.3% in 1995 to 19.9% in 2006. Previous analyses examining only live births failed to explain this trend. We examined trends in preterm delivery (PTD, live births and fetal deaths <37 weeks' gestation) from 1995-2006 using U.S. Vital Statistics Records (fetal death and birth cohort linked birth-infant death datasets). Hypothesis: Birth year will have a significant effect on the odds of PTD after accounting for other known fetal and maternal predictors of PTD. Methods: We excluded 548 observations missing gestational age or <20 weeks' gestation (.08% of 687,492 deliveries) and 57,544 women <18 years old (8.4%) to avoid collinearity between maternal age and education. We used multivariable logistic regression to model the odds of PTD. Independent variables included maternal age, education, smoking, infant sex, plurality, birth year (as a class variable), and interaction terms between maternal age and both education and birth year. We could not control for race or alcohol use because of extensive missing values on fetal death certificates. Results: PTD peaked in 2004 and declined slightly thereafter. After accounting for maternal and fetal characteristics, increasing year of birth remained a significant predictor of PTD ( $\chi^2 = 115.9$ ,  $p < .0001$ ). The adjusted odds ratio for PTD for 2004 vs. 1995 was 2.8 (95% Confidence Interval 1.9, 4.0). Conclusion: The significant increase in PTD remained after accounting for known risk factors. Future research should focus on how societal-level factors like access to healthcare contributed to these trends.

**Heterogeneity and associated population burden of preterm birth risk within traditional BMI categories****Garn JV\*, Kramer MR****(Department of Epidemiology, Rollins School of Public Health and Laney Graduate school, Emory University, Atlanta, Georgia)**

Background: There have been mixed findings in studying the association between preterm birth (PTB= < 37 weeks gestation) and body mass index (BMI; kg/m<sup>2</sup>) in studies operationalizing BMI with traditional categories (underweight <18.5, normal 18.5-25, overweight 25-30, obese >30). A recent case control study reported increasing PTB risk within the normal weight BMI category using a BMI of 24 as the reference. We replicate and expand on this finding using data from the 2009 and 2010 Pregnancy Risk Assessment Monitoring System (PRAMS). Methods: The relationship between continuous BMI and PTB risk was assessed using locally weighted regression and Poisson regression with robust variance. The population burden of BMI was measured using the population attributable fraction (AF). Results: There is a skewed convex relationship between continuous BMI and PTB risk, with a nadir in PTB risk at a BMI of 23, and risk increasing monotonically for both lower and higher BMI values. Using a referent of BMI=23, the PTB risk ratio ranges between 2.0 and 1.4 within the traditional underweight category, between 1.4 and 1.0 within the normal weight category, between 1.0 and 1.2 within the overweight category, and between 1.2 and 1.8 within the obese category. Within the normal category of BMI, 5.1% of PTB is attributable to BMI (reference=23), compared to 2.2%, 4.3%, and 6.5% in the underweight, overweight, and obese categories respectively. Conclusions: Traditional classification of BMI may be inadequate to describe the non-linear heterogeneity and burden of the BMI-PTB relationship, especially within the normal category of BMI.

**Maternal education as risk marker in perinatal health outcomes: EURO-PERISTAT: Data for 2004****Zhang W, Mohangoo A, Zeitlin J, Alexander S\*, & the EURO-PERISTAT group**

Introduction: There are many reports, showing that there is a relation between education and perinatal outcome. However to this day there have been no such data pertaining to the whole of Europe. Methods: EURO-PERISTAT is a collaboration of 29 European countries for perinatal indicators, with an objective of improving perinatal health by supporting decisions of policy-makers. Within this collaboration data were collected from all participating countries for 2004. Data were mostly national and sometimes regional; 26 countries or regions provided data. This abstract presents the European data on maternal education according to ISCED classification, as well as fetal and neonatal mortality by maternal education. Results: Data on maternal education were for 15/26 countries/regions and only 9 used the ISCED classification. Regrouping into three levels of education showed important variations, the range for higher education was from 14% (Italy) to 45% (Finland) of mothers. The highest rates of higher education were in the Nordic and East-European countries. For fetal and neonatal death, data were available for 15 countries/regions. In all countries fetal mortality was inversely related to education, and for neonatal mortality this relation existed in all countries but one. The gradient varied, and was less marked in the Nordic countries. Discussion: Euro-Peristat re-confirms that health inequalities related to social disadvantage are a universal rule, even in countries where the state provides strong social support

**Paternal grandfathers' mortality association with grandchildren's birth-weight differs from that of other grandparents: 2012 mortality follow-up of the Lifeways cross-generation cohort study in the Republic of Ireland**

**Viljoen K\*, Shrivastava A, Murrin C, O'Brien J, Kelleher CC for the Lifeways Cohort Study Steering Group.**

**(Health Research Board Centre for Diet and Health Research, School of Public Health, Physiotherapy and Population Science, University College Dublin, Republic of Ireland)**

**Aims:** There is increasing interest in cross-generation transmission of risk for adult chronic disease, mediated through early childhood growth and development. We aim to differentiate maternal and paternal familial patterns of association with infant birth-weight. **Methods:** Grandparents were categorised as maternal grandmother MGM, maternal grandfather MGF, paternal grandmother PGM and paternal grandfather PGF and linked to grandchild's birth-weight (crude and standardised for gestational age). Mean birth-weight was compared in families where only one index grandparent had died with those where none had died (mutually exclusive deaths). Furthermore, the 4 lineages of deceased grandparents were compared across groups of birth weight. **Results (ANCOVA):** Pure group model (mutually exclusive deaths): After initial adjustment only the PGF line reached significance, with infant BW on average 120gr greater for PGFs who were deceased. On further adjustment significance was lost, however the trend stayed positive. Complete case model: After controlling for all identified covariates, only the PGF mortality status as fixed factor variable reached and maintained significance after full adjustment. Where the PGF was deceased, infants had an adjusted mean BW of around 300gr greater to those with living grandparents. **Conclusions:** Several studies have focussed on the familial patterns of association between maternal mortality and infant birth-weight. This study suggests a positive relationship exists between higher birth-weight infants and paternal grandfathers' mortality. Mechanisms for this merit exploration but this finding is important as few studies have paternal lineage data with capacity to explore this relationship.

**Peripartum and one-year postpartum hysterectomy in New York State, 1995-2004**

**Danilack VA\*, Lipkind H, Elston B, Savitz DA**  
(Brown University, Department of Epidemiology, Providence, RI)

Hysterectomy is a major surgical procedure which precludes future pregnancy in reproductive-aged women. We hypothesized that pregnancy characteristics, complications, and outcomes would influence the occurrence of hysterectomy both during the delivery hospitalization (peripartum) and within the subsequent year (postpartum). We studied 2.4 million deliveries in New York State between 1995 and 2004 with hospital data for delivery and any hospitalizations in the year following delivery. Linked vital records data were available for deliveries occurring in New York City. We excluded women with any diagnosis of uterine, ovarian, or cervical cancer at delivery or postpartum hospitalizations. Among 2,397,949 deliveries, there were 1908 peripartum hysterectomies (7.96 per 10,000 deliveries) and 1343 postpartum hysterectomies (5.61 per 10,000 deliveries). For every one year increase in maternal age, there was a 16% increase in the odds of peripartum hysterectomy and a 14% increase in the odds of postpartum hysterectomy. Adjusting for maternal age, hysterectomy at delivery was more common in women with higher pre-pregnancy weight, greater parity, multiple births, preeclampsia, stillbirth, and in non-whites. Cesarean delivery, in both prior and current deliveries, was associated with hysterectomy at delivery (age-adjusted odds ratio (aOR): 4.4 and 10.0, respectively) and postpartum (aOR: 1.4 and 1.3, respectively). Complications related to placental or uterine issues, or hemorrhage, were strongly related to peripartum hysterectomy. Additionally, placenta accreta (aOR: 2.1), placenta previa (2.1), uterine rupture (3.8), uterine atony (2.0), and postpartum hemorrhage (4.0) were also associated with postpartum hysterectomy. For many pregnancy complications, the risk of hysterectomy extends beyond the delivery hospitalization.

**B94**

**Personality and birth outcomes among adolescents**

**Harville EW\*, Spriggs Madkour A, Xie Y**

**(Department of Epidemiology, Tulane University School of Public Health and Tropical Medicine, New Orleans, LA)**

Background: Adolescent mothers as a group have worse birth outcomes than adult women, but the factors that predict birth outcomes within this adolescent group are not well characterized. Personality is known to be related to a number of health outcomes, but its relationship with birth outcomes has not been well studied. Methods: Data from the National Longitudinal Study of Adolescent Health were used. Participants were 938 adolescent girls who reported on pregnancy outcomes throughout their teenage years. Personality data was taken from the Mini-IPIP personality tool, administered at wave IV, which measures a five-factor personality traits of neuroticism, conscientiousness, intellect/imagination, extraversion, and agreeableness. Linear regression was used to predict birthweight and gestational age with adjustment for confounders. Data were stratified on race to examine possible cultural differences. Results: Higher neuroticism was associated with lower birthweight and gestational age among black girls, but not non-Black. Conscientiousness was associated with lower gestational age among non-Black girls in multivariable analysis. There were weaker tendencies for intellect/imagination to be associated with lower gestational age and conscientiousness to be associated with higher birthweight in Black girls. No relationships were found with extraversion or agreeableness. Conclusions: Personality and race interact to predict birth outcomes in adolescents.

**B95**

**Yogurt intake during pregnancy is associated with reduced preterm birth among lower-BMI women**

**Nicholson JL\*, Ramakrishnan U, Richards JL, Stein AD, Rivera J, Omer SB  
(Emory University, Atlanta, GA)**

Background: Infection and inflammation, recognized determinants of preterm birth (PTB), may account for 25-40% of PTB. Consumption of probiotic-containing foods during pregnancy may reduce risk of PTB by preventing bacterial vaginosis or reducing inflammatory responses. Objective: To evaluate whether consumption of yogurt (a probiotic-containing food) during pregnancy is associated with decreased risk of PTB. Methods: We studied 970 women (18-35 years) enrolled in a randomized controlled trial of prenatal docosahexaenoic acid supplementation in Mexico. Yogurt consumption was reported by women at enrollment (18-22 weeks gestation), and categorized into high ( $\geq 2$  times/week) and low consumption ( $\leq 1$  time/week). PTB was defined as a live birth occurring before 37 weeks gestation. Logistic regression was used to evaluate the association between yogurt consumption during pregnancy and PTB. We adjusted for intervention group, diabetes, hypertension, education, SES, marital status, age, weeks of gestation at enrollment, and total caloric intake at enrollment. Results: The prevalence of preterm birth was 9.2%. There was heterogeneity of the association between yogurt consumption and PTB by maternal weight ( $p=0.0005$ ). Among women with body mass index (BMI)  $< 25$  kg/m<sup>2</sup> at enrollment ( $n=425$ ), higher consumption of yogurt during pregnancy was associated with a 66% reduction in the odds of PTB (OR=0.34, 95% CI: 0.14-0.84). Among women with BMI  $\geq 25$  kg/m<sup>2</sup>, yogurt consumption during pregnancy was not significantly associated with PTB (OR=1.24, 95% CI: 0.70-2.20). Conclusions: Consumption of probiotics during pregnancy may reduce risk of PTB among women of lower BMI. Women with BMI  $\geq 25$  may not experience the same effect.

**Contextual factors associated with timing of diabetes screening during pregnancy and postpartum among commercially insured women in Michigan****Markovitz AR\*, Tao M, Paustian ML****(Blue Cross Blue Shield of Michigan, Department of Clinical Epidemiology and Biostatistics, Detroit, MI)**

Timely glucose screening for gestational diabetes mellitus (GDM) during pregnancy and subsequent postpartum glucose screening provide opportunities for interventions to improve health outcomes. However, previous research suggests sub-optimal adherence to recommended screening guidelines, especially postpartum. This study looked at time from delivery to screening during pregnancy and postpartum. We used proportional hazards models to test associations between contextual factors and timing of prenatal and postpartum glucose screening. Our study included 37,852 Michigan residents who delivered between July 2009 and June 2011 and had continuous insurance coverage spanning 120 days before delivery to 12 weeks after. Using administrative claims, we identified glucose screening between delivery and 120 days prior for all women and six weeks to one year postpartum for women with GDM. Eighty percent of women (n=30,255) were screened for GDM, 67% of whom were screened 12-16 weeks before delivery. Only 716 (26%) of the 2,751 women diagnosed with GDM were screened postpartum and 443 (16%) were screened within the recommended window of 6-12 weeks postpartum. Contextual factors, including increasing poverty level of the area, increasing proportion of minority residents and metropolitan, small town, or rural residence were associated with receiving prenatal screening closer to delivery. These factors were also directionally associated with delayed postpartum screening but were not statistically significant. Glucose screening rates within recommended periods surrounding pregnancy, especially postpartum, is suboptimal and communities often experiencing higher diabetes prevalence are especially affected. Further effort is needed to promote timely postpartum screening to increase early detection and treatment of diabetes.

**B97**

**Preference for cesarean delivery at first childbirth**

**Kjerulff KH\*, Zhu J, Velott D**

**(College of Medicine, Penn State University, Hershey, PA)**

Background: As the cesarean delivery rate has increased, attention has turned to the role that women's preferences play in determining mode of delivery. Method: 3,006 nulliparous women aged 18 to 36 with a singleton pregnancy were interviewed in their third trimester and again one month after childbirth. Results: In the pre-delivery interview 93.9% indicated that they would prefer to deliver vaginally, 3.1% preferred cesarean section and 3.0% had no preference. Overall, 71.3% delivered vaginally, 5.2% by planned cesarean section and 23.6% by unplanned cesarean section. Among those who preferred vaginal delivery, 27.4% delivered by cesarean section; among those who had no preference, 43.3% did; and among those who preferred cesarean section, 55.4% did ( $p < .0001$ ). Women with a preference for cesarean delivery were more likely to deliver by planned cesarean section (33.7%) than women with no preference (13.3%) and those who preferred vaginal delivery (4.0%),  $p < .0001$ . Conclusion: Although only a small percent of women have a preference for cesarean delivery prior to first birth, those who do are more likely to deliver by cesarean section, particularly planned cesarean section.

**Disaster management in perinatal care - Crucial point of helping mothers and babies after 311 Tsunami devastated area**

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The Great East Japan Earthquake and Tsunami occurred in 2011/3/11 and this disaster revealed health care issues that Japan already had. One is the lack of attention for maternal health care in the highly aged society and the other is decreasing OB/GYN providers in the Tohoku area. It was hard to see pregnant people and babies in the highly aged country like Japan, however, there were a few expecting mothers left in the in the cold, hungry and anxious shelter with another people. They were not prioritized as a vulnerable population. In the Hanshin-Awaji Earthquake Report in 1996, there were increased preterm birth rate and miscarriage rate during disaster, and statistically significant increase of low birth weight babies. Continuing research of 11 hospitals and 37 clinics in one prefecture in the devastated area showed that most of pregnant mothers stayed more than 3 evacuation shelters to find a safer place to live and half of the pregnant patients could not find a way to go out from the Tsunami area to have birth. With more than 200 patients who could succeed to transport to another prefecture, their average delivery time (weeks of gestation), weight of baby, preterm birth rate, low birth weight rate, amount of blood loss and another birth outcomes of this catastrophic area tells us the importance of the pre-hospital OB/GYN care team in disaster response and safety confirmation system for mothers and babies. We should strengthen the perinatal care in highly aged society where mothers are minority.

**Risk factors and health during pregnancy among women previously exposed to sexual violence: a population-based cohort study**

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Objective: To determine whether women exposed to sexual violence are more likely than non-exposed to present with subsequent pregnancy or birth complications. Methods: In this register-based cohort study we linked data from a Rape Trauma Service (RTS) in Iceland with data from The National Medical Birth Registry (MBR). Our exposed cohort consisted of women who attended the RTS through 2008 and subsequently gave 925 births to end of follow-up, April 2011. Our non-exposed cohort included 1771 women who had not attended RTS and were randomly selected from the MBR. Poisson regression was used to obtain Relative Risks (RR) with 95% confidence intervals (CI). Results: Compared with non-exposed mothers, exposed mothers were younger, more likely to be unemployed and not cohabiting. Exposed mothers in their first subsequent pregnancy were more likely than non-exposed to smoke (RR 2.51: CI 2.12–2.96), use illicit drugs (RR 6.85: CI 2.38–19.71) and having an early pregnancy Body Mass Index (BMI)  $\geq 30$  (RR 1.31: CI 1.05–1.64), after adjusting for age and parity. There were no statistically significant differences regarding gestational hypertension or preeclampsia. Women delivering within three years of the exposure had an increased risk of gestational diabetes compared to non-exposed women (not statistically significant after adjusting for BMI). Preliminary findings on birth outcomes indicate increased risk for induced labor and instrumental delivery. Conclusions: Women previously exposed to sexual violence more often present with vulnerability factors during pregnancy, of pivotal importance for maternal health and fetal development. They may also be at increased risk of obstetric interventions.

**B100**

**Prediction of obstetrical risk using maternal serum markers and obstetrical history**

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Objectives: Abnormal maternal serum analytes measured as part of screening programs for fetal aneuploidy (pregnancy associated plasma protein A (PAPP-A), total human chorionic gonadotropin (hCG), alpha fetoprotein (AFP), inhibin A and unconjugated estriol) have been associated with adverse obstetrical outcomes in chromosomally normal pregnancies; however, the predictive ability of these models has been low. This study aimed to determine if the predictive ability could be enhanced through the addition of clinical variables. Methods: A split-sample design was used to develop and validate prognostic models for serious perinatal events (stillbirth, preterm birth <32 weeks, or HELLP syndrome) using stepwise backwards logistic regression. Model discrimination was assessed using the area under of the curve (AUC) of the ROC curve. This analysis was restricted to chromosomally normal singleton pregnancies that were delivered at or after 20 weeks of gestation (n=45,355) and excluded pregnancy terminations. Results: AFP, Inhibin, PAPP-A, obstetrical history, and antepartum haemorrhage in the current pregnancy were significantly associated with experiencing a serious perinatal event. The discriminative ability of this model was low (AUC=0.66), but was greater than the discriminative ability of models based exclusively on obstetrical risk factors (AUC=0.59) or maternal serum markers (AUC=0.62). Of women with a predicted probability  $\geq 10\%$ , approximately 1 in 4 experienced a serious perinatal event, compared to a background rate of 1 in 100. Conclusions: While detection rates are modest, the addition of maternal serum marker data enhances the predictive ability of models examining adverse perinatal outcome beyond what is observed with clinical variables alone.

**B101**

**Does neighborhood deprivation affect maternal psychosocial distress during pregnancy?**

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Neighborhood deprivation is often associated with adverse pregnancy outcomes. One of the most prevailing hypotheses is that pregnant women in socioeconomically deprived areas experience greater psychosocial distress resulting in adverse birth outcomes. However, empirical evidence of this proposed mechanism is scant. Based on a large multicenter cohort of pregnant women in Montreal, we examined (1) to what extent psychosocial distress is clustered at neighborhood-level; (2) to what extent the clustering is explained by neighborhood material or social deprivation; and (3) whether associations of neighborhood deprivation persisted after controlling for neighborhood composition (individual-level characteristics) using multilevel analyses. Our study included 5,218 women residing in 740 neighborhoods with psychosocial distress measured at prenatal interview during 24-26 gestational weeks. Neighborhood deprivation indices obtained from a Montreal-based spatial data infrastructure were linked to study participants by their residential postal code. Neighborhood-level clustering (intra-class correlation) ranged from 1-2% for perceived stress (lowest), optimism, pregnancy-related anxiety, and commitment to pregnancy to 4-6% for perceived social support, depressive symptoms, and maternal locus of control (highest). Neighborhood material deprivation explained more of the between-neighborhood variations in these measures (22-78%) than did social deprivation (0.4-3.6%). 40% of between-neighborhood variation in maternal locus of control was explained by neighborhood material deprivation vs 3.6% by social deprivation. For both material and social deprivation, however, associations with psychological distress disappeared after adjusting for individual-level maternal age, marital status, parity, and socioeconomic position. Our findings have important methodological implications for future perinatal epidemiologic research for understanding neighborhood effects.

**B102**

**The impact of tobacco control policies on disparities in birth weight**

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Although maternal smoking during pregnancy is a modifiable risk factor for birth weight, there is little known whether interventions targeting smoking would impact birth weight. Using a 15% sample from the national birth files on all births in 29 states from 2000-2009 (N=1,970,677), we used a conditional mixed-process model to assess the impact of changes in cigarette excise taxes on disparities in birth weight. In the first stage, we estimated a probit differences-in-differences regression model to examine the effect of cigarette taxes on maternal smoking during pregnancy. In the second stage, we estimated a linear model to examine the effect of a change in the predicted probability of smoking on birth weight for a \$1.00 cigarette tax. Models included interactions between maternal race/ethnicity, education, and taxes as well as state- and year-fixed effects. We restricted analyses to singletons with gestational ages between 37-41 weeks. From 2000-2009, 28/29 states increased cigarette taxes, from 46 cents to \$1.47, and maternal smoking decreased from 11.2% to 9.1%. Overall, we found that maternal smoking during pregnancy reduced birth weight by an average of 250 grams and separately, maternal smoking was responsive to cigarette tax increases. Among mothers with a high school degree or less, a \$1.00 increase in taxes increased birth weight by 6.8 grams for white mothers and 4.3 grams for black mothers. We plan to rerun the analyses using the full dataset of 13 million births. Our preliminary results suggest that cigarette taxes may be a potential population-level intervention to increase birth weight.

**B103**

**Maternal vitamin D status and risk of placental inflammatory pathology**

**Gernand AD\*, Simhan HN, Parks WT, Klebanoff MA, Bodnar LM  
(University of Pittsburgh, Pittsburgh, PA)**

Maternal vitamin D status has been associated with fetal size but mechanisms are unclear. We examined the association between maternal serum 25-hydroxyvitamin D (25(OH)D) concentrations at  $\leq 26$  weeks' gestation and placental inflammatory lesions in a large cohort of singleton infants in the Collaborative Perinatal Project (1959-65; n=2567). 25(OH)D was measured by LC-MS/MS. A dichotomous construct was created from the presence of 8 pathologies identified on placental exams, including evidence of neutrophilic infiltration and bacterial colonies (n=447 cases). Maternal vitamin D status has been associated with fetal size but mechanisms are unclear. We examined the association between maternal serum 25-hydroxyvitamin D (25(OH)D) concentrations at  $\leq 26$  weeks' gestation and placental inflammatory lesions in a large cohort of singleton infants in the Collaborative Perinatal Project (1959-65; n=2567). 25(OH)D was measured by LC-MS/MS. A dichotomous construct was created from the presence of 8 pathologies identified on placental exams, including evidence of neutrophilic infiltration and bacterial colonies (n=447 cases). We used binomial regression models to examine the association of vitamin D and risk of placental inflammation after adjusting for gestational age at blood draw, season at blood draw, maternal race/ethnicity, latitude, and infant sex. The relationship between maternal 25(OH)D and placental inflammatory lesions was modified by infant sex (p=0.02). Among female infants, lesions were more frequent in women with 25(OH)D  $< 80$  nmol/L (16%) vs.  $\geq 80$  nmol/L (10%; p=0.02). Risk of lesions increased by 87% (95% CI: 1.15, 3.04) for maternal 25(OH)D  $< 80$  vs.  $\geq 80$  nmol/L among females, but not among males (RR: 0.84, 95% CI: 0.63, 1.14) in adjusted models. There was no meaningful difference after excluding stillbirths or induced labors or controlling for length of labor. We have previously shown an association between maternal vitamin D status and placental vascular lesions that differed by infant sex. These data suggest an association between vitamin D and placental infection among females, and warrant further research in efforts to explain the vitamin D and fetal growth connection.

**B104**

**Life course body weight and risk of preterm delivery**

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Studies have examined the association between prepregnancy body size and preterm birth (PTB), but there has been little research considering body size across the life course and PTB. We examined this relationship in a cohort study of PTB in Black women in Southfield, Michigan (N=1411; 71% response rate). Data about three time periods (birth, age 18, prepregnancy) were obtained from maternal interview and medical record abstraction. Percentiles of body weight were calculated from the sample distributions at each time point. Prevalence ratios (PR) and 95% confidence intervals (CI) were calculated using log-binomial models. The PTB rate was 16.4%. Six weight percentile trajectory groups were estimated and classified based on the trajectory's beginning and endpoint (high-high, high-medium, high-low, low-high, low-medium, low-low). The PTB rate differed across the groups ( $p=0.02$ ). The trajectory that began at a low weight percentile (25th) and ended near the 75th percentile (low-high group) had the highest PTB rate (23.3%). Similar but not as high risk was the group that also began low but remained low (17.9%). This is consistent with our finding that mothers who were born low birth weight had an increased risk for PTB (PR=1.56 95%CI=1.03, 2.34). Both groups with medium end points had lower PTB rates, albeit slightly different, regardless of starting point (high-medium, 12.2%; low-medium, 13.4%). The two groups beginning at the high point regardless of the endpoint had intermediate PTB risk (high-high, 15.7%; high-medium, 16.3%). These results suggest that body size and growth across the life course impacts the risk of PTB.

**B105**

**Caffeine consumption, smoking and preeclampsia in the Norwegian Mother and Child Birth Cohort**

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Preeclampsia, a condition characterized by prenatal hypertension and proteinuria, can harm both mother and baby. Factors involved in vasodilation may play a role in preeclampsia, and caffeine consumption is one such factor. This study uses a subset of 74,439 singleton pregnancies from the Norwegian Mother and Child Cohort Study. Caffeine was measured by self-report at first and third prenatal questionnaires. Exposure was categorized as no caffeine and into quartiles above zero. We focus primarily on early pregnancy caffeine consumption to ensure that consumption preceded the onset of symptoms. Log-binomial regression models were used to produce risk ratio (RR) estimates. Maternal age, education, parity, body mass index, and nausea during pregnancy were considered as confounders. No overall effect of early pregnancy caffeine consumption on preeclampsia was found in the fully adjusted model comparing the highest quartile to no exposure (RR=1.01, 95% CI 0.89, 1.14). However, caffeine consumption was associated with a reduced risk of preeclampsia among smokers (RR caffeine + smokers= 0.71, 95% CI 0.56, 0.90; RR caffeine + non-smokers = 0.98, 95% CI 0.85, 1.12), comparing the highest caffeine exposure to no exposure (p interaction = 0.03). In conclusion, we found a slightly reduced risk of preeclampsia among women who both smoked and consumed a large number of caffeinated beverages in early pregnancy. These results further highlight that a subset of women who report these two behaviors that are actively discouraged during pregnancy have a low risk of developing preeclampsia, although the relationship between these factors may not be causal.

**B106**

**Gestational age patterns in cesarean section rates: an international comparison**

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Objective: While international variations in overall cesarean section rates are well documented, less information is available for specific clinical sub-groups. We studied differences in the use of cesarean section by multiplicity and gestational age. Methods: This study used routine aggregate data from 17 European countries and the United States on the number of singleton and multiple live births with cesarean versus vaginal delivery by week of gestation in 2008. Overall and gestation-specific cesarean section rates were analyzed. We computed rate differences and rate ratios to compare practices for selected gestational age groups (very preterm, preterm, near term, term and post-term). Results Cesarean rates for singletons varied from 15% (the Netherlands and Slovenia) to over 30% (US and Germany). Everywhere, rates were highest for very preterm deliveries and declined to lows at 40 weeks of gestation (8.0% for Sweden and Norway to 22.5% in the US). However, patterns of change differed; the average rate difference between very preterm and term births was 42 points, but this ranged from 15% to 57%. High variations in rate differences and ratios were also observed for near term versus term births. For multiples, rates declined by gestational age in some countries, whereas in others rates were similar across all weeks of gestation. Conclusions Gestational age patterns in the use of cesarean section were highly heterogeneous across countries; these differences highlight areas where consensus on best practices is lacking and could inform strategies to promote the reduction of cesarean section rates.

**B107**

**Maternal characteristics as predictors of serum 25-hydroxyvitamin D among pregnant women living in North Carolina, 1997-2005**

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Background: Approximately 10% of females of reproductive age in the U.S. have deficient levels of vitamin D, and non-Hispanic Blacks exhibit a disproportionate prevalence of deficiency compared to non-Hispanic Whites. We examined maternal characteristics as predictors of serum 25-hydroxyvitamin D level (25(OH)D) during pregnancy. Methods: Our study sample included 992 non-Hispanic White and Black women selected into a nested case-control analysis using data from the Pregnancy, Infection, and Nutrition Study. We used univariate regression to assess linearity of each predictor of 25(OH)D; for variables that violated the linearity assumption, we created spline or curvilinear functions for use in multivariate models. Stepwise backward elimination of uninformative variables in multivariate linear regression was based on Student's t-test using a priori alpha levels of 0.05 and 0.10 for main effects and interactions, respectively. Results: Median gestational age at blood draw was 19 weeks (interquartile range: 17, 26), and 25(OH)D followed an approximate normal distribution (mean=27 ng/mL, standard deviation=11). 35% of women were Black, 20% reported smoking during pregnancy, and 63% reported vitamin supplementation during pregnancy. Controlling for seasonal variation and other maternal factors, Black race was associated with decreased 25(OH)D (beta=-12.0 ng/mL, standard error=0.7). Other maternal characteristics that predicted 25(OH)D were increasing parity (beta=-1.5 ng/mL per child, standard error=0.3), smoking during pregnancy (beta=-2.3 ng/mL, standard error=0.8), and maternal age. These factors explained 33% of observed variation in 25(OH)D. Conclusions: Maternal characteristics are independent predictors of vitamin D status during pregnancy, calling attention to groups of people who may be at risk of deficiency.

**B108**

**Cold temperature during pregnancy and birth outcomes in Uppsala, Sweden, 1915 to 1929**

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The literature reports adverse birth outcomes following ambient heat. Less work focuses on birth outcomes following cold, and we know of no studies of cold that examine stillbirth. We test the relation between cold ambient temperature during pregnancy in Sweden and four outcomes: stillbirth, preterm, birthweight for gestational age, and birth length for gestational age (a measure of leanness). We examine births from 1915 to 1929 in Uppsala, Sweden which unlike most societies today experienced sub-standard indoor-heating and fewer amenities to provide shelter from cold. We retrieved data on almost 14,000 deliveries from the Uppsala Birth Cohort Study. We linked a validated, daily ambient temperature series to all pregnancies. We applied Cox proportional hazards for time-to-event outcomes (stillbirth and preterm) and linear regression for birthweight and birth length. Month indicator variables controlled for confounding by season. The risk of both stillbirth (but not preterm) rises as ambient temperature during pregnancy falls (hazard ratio [HR] of stillbirth for a 1.0°C fall in temperature = 1.09; 95% Confidence Interval [CI]: 1.01 - 1.18). Infant birth length for gestational age declines with lower temperatures. We observe no relation between cold and birthweight for gestational age. In historical Sweden, cold temperatures during pregnancy increase the risk of stillbirth and infant leanness. Our work holds relevance to maternal-fetal biology as well as to contemporary societies (e.g., indigenous Arctic populations) with limited resources to mitigate the adverse consequences of cold.

**B109****Characteristics of U.S. women with interpregnancy intervals less than 12 months or greater than 60 months****Cheslack-Postava K\*, Winter AS****(Department of Epidemiology, Columbia University, New York, NY)**

Both short and long interpregnancy intervals (IPI) have been associated with adverse perinatal and developmental outcomes. However, limited research has addressed factors associated with IPI in general population samples, and the role of pregnancy intention is unclear. Data on 10,277 pregnancies following a prior live birth were drawn from the 1995, 2002, and 2006-2010 waves of the National Survey of Family Growth. Logistic regression was used to model the association of IPI<12 months and >60 months versus IPI of 12-60 months with maternal demographic characteristics, outcomes of prior pregnancy, and history of pregnancy intention. Additional analyses were stratified by whether the current pregnancy was intended. Overall, 17.1% of pregnancies had IPI<12 months and 20.5% had IPI>60 months. Intended pregnancies accounted for 32% and 49% of these, respectively. Among all pregnancies, risk for IPI<12 months was inversely associated with maternal education and income. Other variables were risk factors for IPI<12 months specifically among intended pregnancies, including: maternal age>35 (odds ratio (OR)=1.94, 95% confidence interval (CI) [1.12, 3.37]), black race (OR=1.67, 95% CI [1.17, 2.37]), being widowed, divorced, or separated at time of the prior birth, (OR=1.96, 95% CI [1.19, 3.23]), prior infant death (OR=4.61, 95% CI [1.78, 11.9]), and reporting that the prior pregnancy occurred later than desired (OR=2.24, 95% CI [1.15, 4.35]). Increased risk of IPI>60 months was associated with younger age at prior pregnancy, minority ethnicity, and higher income. IPI<12 months and >60 months are prevalent occurrences among U.S. pregnancies and certain risk factors are specific to intended pregnancies.

**B110**

**Fathers Matter: The role of paternal age and infant mortality**

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Background: Infant mortality is the most widely utilized indicator of a nation's health status, and is associated with a plethora of maternal and socioeconomic factors. The link between paternal age and birth outcomes has received little attention. This study seeks to examine the added impact of paternal age on infant mortality, above and beyond that of maternal age among married couples, using combined parental age and influence of prenatal care in mediating risks. Methods: The 2002 linked birth and infant death dataset (N=63,754), Cox's proportional hazard ratios for the association between combined maternal and paternal age and the infant mortality risk were estimated. All tests were two tailed, and used standard p-value significance. Data with missing information were removed from the study. Maternal demographic characteristics, such as education, and race/ethnicity were controlled. Results: Older mother and young father couples had highest infant mortality rates, which was statistically significant. The key findings indicate that, independent of maternal education and race/ethnicity, young paternal age adds additional risk, above and beyond that of maternal age, only when the mother is older (HR=2.7). Conclusions: Although paternal age has an effect on birth outcomes independently, to our knowledge, this is the first study to examine male age related disparity and pregnancy outcomes using a combined parental age variable. This study highlights the importance of young paternal age as a significant factor in the risk of infant death, however, more research is needed to further develop the understanding of the relationship between paternal age and infant mortality.

**B111**

**As the mercury rises, does the risk of preterm delivery?**

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Heat waves are likely to increase in severity and duration in the future. Few studies have been conducted to examine the effect of temperature on adverse birth outcomes. This study assesses the relationship between heat and humidity and preterm delivery (PTD). We conducted a time-stratified case-crossover analysis using data from Kaiser Permanente Northern California (KPNC) women who had a PTD identified by electronic medical records. 16,635 PTDs were identified between January 1, 1999 and December 31, 2009. These data were combined with meteorologic monitoring data based on residential zip codes that had monitors within 20 kilometers. Preliminary analyses suggest a relationship between high apparent temperature and PTD. A 3.98% increase (95% CI: 0.90%, 6.95%) in PTD was associated with every 10°F increase in weekly average (lag06) apparent temperature. Season (warm vs. cold) and sub-type of preterm delivery (length of gestation) modified these findings. An elevated relationship emerged in the warm season, with a 6.95% increase (95% CI: 2.00%, 11.86%) in PTD associated with every 10°F increase in weekly average apparent temperature compared to 1.0% (95% CI: -4.01%, 4.98%) in the cold season. Pregnancies between 35-36 weeks in the warm season were at the highest risk with a 9.9% increase (95% CI: 3.98%, 16.71%) in PTD associated with every 10°F increase in weekly average apparent temperature compared to 3.98% (95% CI: -5.03%, 9.90%) for <35 weeks and -5.03% (95% CI: -26.70%, 17.68%) for 37 weeks. These findings suggest pregnant women are a vulnerable population to target with interventions associated with heat waves and climate change.

**B112**

**Antidepressant use late in pregnancy and risk for persistent pulmonary hypertension of the newborn (PPHN) among low-income women**

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The association between selective serotonin reuptake inhibitor (SSRI) antidepressant use during pregnancy and risk of persistent pulmonary hypertension of the newborn (PPHN) has been controversial since the Food and Drug Administration issued a Public Health Advisory in 2006. Previous studies reached discrepant conclusions and were limited by insufficient size, potential confounding by indications, and improper adjustment for potential mediators. We evaluated the association in a large cohort of pregnant women enrolled in US Medicaid. We identified a cohort of 103,491 pregnancies in which women had depression diagnoses from 2000-2007 Medicaid healthcare data. Women were classified according to pharmacy dispensing records as exposed to SSRI or non-SSRI monotherapy in the 90 days before delivery or as unexposed. We estimated relative risks (RR) and 95% confidence intervals (CI) adjusted for PPHN risk factors, depression severity proxies, other antidepressant indications, and other medications. PPHN claims had a positive predictive value of 68% according to medical record validation. The risk for PPHN among women with depression unexposed to antidepressants was 0.14%. Compared to unexposed women, the unadjusted RR for PPHN among women exposed to SSRIs was 1.4 (CI: 0.9-2.0) and it was 1.5 (CI: 0.8-2.8) for non-SSRIs. After covariate adjustment the RRs were 1.3 (CI: 0.9-1.8) for SSRIs and 1.2 (0.6-2.3) for non-SSRIs. In this Medicaid population, the association between antidepressants and PPHN was weak. The risk of PPHN would increase from approximately 1 case per 1000 births among women not using antidepressant to 1.5 cases per 1000 births among women using antidepressant.

B113

**Is childhood neighborhood context associated with preterm birth? The Life-course Influences on Fetal Environment (LIFE) Study.**

**Osypuk TL \*, Caldwell CH, Sealy-Jefferson S, Slaughter JC, Straughen JK, Dailey R, Helmkamp L, Misra DP  
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**Although early life neighborhood environment may play an important role for patterning early life socioeconomic status, parental relationship quality, physical toxins, or other exposures that influence preterm birth (PTB) during a woman's childhood, few epidemiologic studies have considered early-life neighborhood context as a predictor of later-life health. We tested whether a woman's early-life neighborhood environment was associated with giving birth to a PTB infant. Data derive from the LIFE cohort study of PTB among black women in Southfield Michigan (71% response rate). PTB was defined as birth less than 37 weeks of completed gestation. Neighborhood environment when a woman was aged 10 was measured retrospectively by two separate survey reports of two raters: the recently postpartum woman herself, and her mother (grandmother of index infant) (n=575 pairs). Neighborhood was operationalized with two subjective measures: neighborhood social disorder and neighborhood social control (each dichotomized at the mean). Age-adjusted logistic regression found that reporting worse childhood neighborhood social disorder was associated with nonsignificantly higher risk of PTB compared to reporting social disorder below the mean. Grandmother's reports of neighborhood social disorder (referring to when her daughter was age 10) exhibited stronger associations with PTB (Odds Ratio (OR) = 1.43, 95% CI: 0.90,2.28) than the woman's own reports (OR=1.32, 95%CI: 0.85,2.10). There were no associations for neighborhood social control. Our results may be underpowered, but these preliminary results suggest childhood neighborhood environment may play a role in patterning early-life exposures that influence preterm birth.**

**B114**

**Prevalence estimates of gestational diabetes mellitus in the United States, PRAMS, 2010**

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Background: Prevalence estimates for gestational diabetes mellitus (GDM) range from 4% to 14% of pregnancies in the United States annually. However, to date, population-based estimates do not exist. Methods: We used the 2010 Pregnancy Risk Assessment Monitoring System (PRAMS) to estimate the prevalence of GDM in 15 states and New York City. States were included if they had adopted the 2003 revised birth certificate and met the 65% response threshold for the PRAMS questionnaire. We compared prevalence of GDM based on the birth certificate, questionnaire, and the two sources combined overall and by state. The phase 6 (beginning 2009) core PRAMS questionnaire and the 2003 revised birth certificate have improved GDM ascertainment questions compared to their previous versions. Questionnaire data is based on self-reported answers to, Were you told by a doctor, nurse, or other health care worker that you had gestational diabetes? Birth certificate data is based on a check-box for pre-pregnancy or gestational diabetes. Data were weighted to represent all women delivering live births in each state during 2010. Results: The overall prevalence of GDM in 2010, reported either on the birth certificate or PRAMS questionnaire, was 10.0%. The birth certificate alone reported 4.6% and the questionnaire alone reported 9.4%. State-specific estimates ranged from 3.0% to 12.7%, depending on the data source. Conclusion: Our findings provide 2010 population-based estimates of GDM. Combining revised birth certificate and PRAMS questionnaire data yielded a higher and likely more accurate prevalence estimate of GDM than either source alone.

**Residential mobility in the perinatal period among a statewide representative sample of women, 2003 - 2007**

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Background: Researchers are increasingly interested in using geocoded addresses from birth records or post-partum surveys (e.g., Pregnancy Risk Assessment Monitoring System [PRAMS]) to investigate how neighborhood factors such as socioeconomic status (SES) impact perinatal health. However, evidence suggests that 13 to 41 percent of women move during the perinatal period, suggesting the potential for substantial measurement error in neighborhood SES as well as differential measurement error by maternal demographic or socioeconomic characteristics. Methods: Our sample included 18,273 California women from the 2003-2007 Maternal and Infant Health Assessment (MIHA) linked to birth records. We examined the prevalence of self-reported moving during pregnancy and in the first 2-7 months post-partum by maternal demographic and socioeconomic characteristics. We then categorized neighborhood SES using a principal components analysis index and examined whether mobile women moved within their neighborhood or to neighborhoods of similar, lower, or higher SES. Results: Mothers who were young (<21 years), unmarried, non-Hispanic black or US-born Latina, or without a college education had the highest prevalence of perinatal residential mobility. Most movers (86%) stayed within their neighborhood; 7.5% moved to a neighborhood of similar SES, 3.9% moved to a higher SES neighborhood, and 2.8% moved to a lower SES neighborhood. Conclusions: Residential mobility in the perinatal period occurs primarily within neighborhood or between neighborhoods of similar SES; birth records, MIHA, or PRAMS may therefore be adequate for assessing neighborhood SES. However, there is also evidence of strong race/ethnic and socioeconomic disparities in residential mobility during this important time period.

**B116**

**General characteristics of women missing maternal weight measurements for first trimester Down syndrome screening**

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Background: Maternal weight is an important clinical variable that is used to adjust risk ratios for Down syndrome screening and is frequently not recorded. Objective: To compare general characteristics for women with and without data on maternal weight for first trimester Down syndrome screening. Methods: The study included consecutive women with singleton pregnancies attending Down syndrome screening in Northern Sydney, Australia, 2007-2009. Records were linked to an obstetric hospital database for additional demographic and clinical information, including self-reported pre-pregnancy weight and height. Results: During the study period, 3,047 women attended Down syndrome screening. Almost 80% (n= 2,411) of women had a corresponding record in the obstetric database, with maternal weight missing for 368 (15.3%) women. Of women with maternal weight information from screening data, the proportion of underweight, normal weight, overweight and obese women were 6.4%, 61.3%, 18.4% and 9.3%, respectively. When self-reported pre-pregnancy weight and height values from the obstetric database were examined for women with missing weight in the Down syndrome database, 9.1% were underweight, 69.7% normal weight, 13.0% overweight and 6.9% obese. Conclusions: Women with unrecorded weight at screening tended to be more underweight and less overweight or obese compared to those with weight recorded. Impact of missing weight information on prenatal Down syndrome risk ratios should be assessed. Keywords: pregnancy, weight, Down syndrome, screening

**B117**

**Missing data of composite endpoints with large neonatal follow-up data: A case study of Neonatal Research Network Japan database**

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Composite Endpoints are often used with neonatal follow-up data in paediatric and perinatal epidemiology. This study addresses the handling and imputations for missing data of composite endpoints in a large neonatal follow-up data. Estimation of the intervention effect or risk factor on development outcome in neonatal follow-up study often complicated when study participants had missing data. Followed up data have types of outcomes such as mortality, mobility or developmental scales (binary or continuous variable). These variables are used as a combined outcome for the analysis. In the case, interpretation of problem with missing data would be more complex. Illustrative data were derived from 10394 infants in very low birth weights participating from 2003-2007 years in the Neonatal Research Network Japan database. Imputations of missing data and their sensitivity analysis were used to ensure that data analysis samples reflect the full population of infant participating in this study. This case study provides an illustration to assist researchers in implementing composite endpoints with missing data in neonatal follow-up study.

**B118**

**Multiple adaptive recruitment methods for large-scale enrollment of first-trimester pregnant women**

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Recruitment of pregnant women for large-scale clinical trials has often been problematic, time consuming, and expensive. Pregnancy may affect women's ability to make a free choice: they may feel bound to accept interventions benefiting the fetus or refusing treatment for themselves in case it should harm the baby. The father and family members may also influence women's decision-making when enrolling into a study. The e-Moms of Rochester Study, an electronic intervention promoting healthy weight during pregnancy and post-partum, used a cross-over of recruitment and enrollment methods to address the challenges presented the sample size and unique characteristics of this population. Three adaptive methods were effectively employed despite a small recruitment budget and limited study staff. Strategies included study staff in-person interaction at obstetricians' offices, care-provider referral encouraging the participant to contact study staff, and online self-screening/enrollment. These three recruitment methods yielded a racially (40% minority) and ethnically (13% Hispanic) diverse sample of 1,722 pregnant women over a 14-month period. The most effective method (71.4%) in terms of yield was in-person enrollment at obstetrical offices. The least effective method (8.0%) was participant referral by obstetrician. Self-screening/online enrollment by women contributed 20.6%. A high average rate of 29 enrollments/week was achieved using these three adaptive recruitment methods in conjunction with community-based efforts. Multiple exposures to study information, adequate time to review enrollment documents, availability of study staff to answer questions, and receiving consultation and/or assurance from participants' obstetricians were factors that helped shape enrollment methods and successful recruitment of pregnant research participants.

**B119**

**Demographic, behavioral, and reproductive history differences by maternal working status before and during pregnancy: Implications for reproductive studies**

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Studies of occupational exposures among reproductive-aged women must address biases that could be caused by self-selection to employment. Data from controls in the National Birth Defects Prevention Study with births from 1997-2007 were used, representing a random sample of live births unaffected by birth defects. We compared personal and household characteristics of women who held any job during the 3 months prior to conception through the end of pregnancy (n = 5978, 71.7%) to those of women who did not hold any job in this period (n = 2365, 28.3%). Patterns of maternal work were also evaluated, including: frequency of part-time, full-time, and long work hours; job change; and job cessation. Most women who did not work during this period self-identified as homemakers/parents (80.4%) or students (14.1%); few reported being disabled (1.2%) or between jobs/unemployed (3.5%). Maternal age, parental race, parental nativity, parental education, and household income differed between families of working and nonworking women. Non-working women were more likely to be multiparous compared to working women (73.8% vs. 54.4%). Working women were more likely to have planned their index pregnancy and have used fertility drugs or treatments to conceive, however they were also more likely to report pregnancy risk behaviors including not using a folic acid supplement during the periconceptional period, smoking, drinking alcohol, and paternal (but not maternal) use of illicit drugs. These patterns could introduce bias in studies of occupational exposures in relation to reproductive outcomes that are not restricted to workers only.

**B120**

**Innovative saliva collection device for infants enrolled in epidemiologic studies**

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To collect saliva from infants for analyses of cortisol and isoflavones, we used a non-commercially available saliva collection device designed and validated for dental studies in adults. After receiving permission from the designer and following the patented manufacturing instructions for the device, which consisted of four parts, a buffering chamber, rigid tubing for collection, a storing tube and a suction device, we worked with a commercial machine shop to fabricate several copies of the device. We piloted the device for use in infants and successfully collected 350 saliva samples from 166 infants, as young as 4 weeks of age. More recently, the device has been used to collect over 500 saliva samples at multiple time points from 300 infants starting at 8 weeks of age in a longitudinal epidemiologic study. For pediatric protocols including a saliva collection, this device has many advantages. It is fairly easy to fabricate the buffering chamber at relatively low cost and the other parts and disposable supplies can be purchased from commercial vendors. The device is easy to assemble and clean, requires minimal training of field technicians, and is small, lightweight and portable. The efficient design has the saliva being collected directly into the vial. Two mls of saliva were easily obtained in 5-10 minutes from infants as young as 4 weeks of age, although 8 weeks of age is recommended due to the onset of teething. Finally, it is a method that is safe and well accepted by infant participants and their families.

**B121**

**Pigmentary traits, family history of melanoma and the risk of endometriosis: A prospective study of US women**

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Background: Endometriosis has been associated with a higher risk of cutaneous melanoma, but the mechanisms underlying this association are unknown. Some constitutional factors known to influence melanoma risk have been associated with endometriosis in retrospective studies. However, no prospective data are available, and more research is needed to confirm this potentially novel endometriosis risk profile. Methods: To investigate the relationships between pigmentary traits, family history of melanoma and endometriosis risk, we analyzed data from the Nurses' Health Study II, a prospective cohort of 116,678 female US nurses aged 25-42 years at enrollment in 1989, and followed for >20 years since. We used Cox proportional hazards regression models to calculate multivariable relative risks (RR) and 95% confidence intervals (CI). Results: During 621,736 woman-years of follow-up, 4705 cases of laparoscopically-confirmed endometriosis were reported among premenopausal Caucasian women. Endometriosis risk was increased with presence of nevi on the lower legs (RR=1.08, 95% CI=1.01-1.14), higher level of skin's burning reaction to sun exposure in childhood/adolescence (burn with blisters: RR=1.18, 95% CI=1.03-1.34; compared with practically none; P for trend=0.003), and family history of melanoma (RR=1.13, 95% CI=1.01-1.26). Conclusion: This prospective assessment reports positive associations between pigmentary traits, family history of melanoma and endometriosis risk. Our findings add to the emerging evidence on these associations and call for further research to better understand the underlying mechanisms.

**B122**

**Psychosocial stress and risk of uterine leiomyomata in black women**

**Wise LA\*, Li S, Palmer JR, Rosenberg L**  
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Emerging research suggests that exposure to psychosocial stress increases risk of uterine leiomyomata (UL). UL are a major source of gynecologic morbidity in black women. We assessed the association between various measures of stress in adulthood and UL incidence among 23,527 premenopausal participants in the Black Women's Health Study, a prospective cohort study. Women were asked about perceived stress in 2005 (PSS-10 scale), depressive symptoms in 1999 and 2005 (CES-D scale), and caregiver responsibilities in 1995 and 2011. Biennial follow-up questionnaires from 1997 through 2011 identified new UL diagnoses. Age- and period-stratified Cox regression models were used to derive incidence rate ratios (RR) and 95% confidence intervals (CI) adjusted for lifestyle, anthropometric, and reproductive factors. During 1997-2011, there were 7,861 incident cases of UL confirmed by ultrasound or surgery. During follow-up from 2005-2011, RRs for PSS-10 scores of 9-12, 13-16, 17-20, and  $\geq 21$  (high stress) relative to  $< 9$  (low stress) were 1.14 (95% CI=0.97-1.34), 1.02 (95% CI=0.87-1.21), 1.16 (95% CI=0.98-1.36), 1.22 (95% CI=1.04-1.43), respectively (P-trend=0.02). During follow-up from 1999-2011, RRs for CES-D scores of 16-24 and  $\geq 25$  (high depressive symptoms) relative to  $< 16$  (low depressive symptoms) were 1.11 (95% CI=1.03-1.20) and 1.19 (95% CI=1.09-1.31), respectively (P-trend $< 0.001$ ). Risk was also elevated for women with a history of clinical depression (RR=1.22, 95% CI=1.12-1.33). There was little evidence of an overall association between caregiving responsibilities (1995) and UL risk (RR=1.06, 95% CI=1.00-1.13). However, in cross-sectional analyses of 2011 data, caregiving perceived as 'high stress/low reward' was associated with a 12% increased risk of UL (95% CI=1.01-1.24) relative to 'low stress/high reward' caregiving. Our data indicate a positive association of perceived stress, depression, and caregiver stress with incident UL in black women.

**B123**

**Prenatal exposure to Diethylstilbestrol and reproductive hormones in premenopausal women**

**Wise LA\*, Troisi R, Hatch EE, Titus LJ, Palmer JR, Vitonis A, Harlow BL  
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Diethylstilbestrol (DES), a synthetic estrogen prescribed to pregnant women in the mid-1900s, is a potent endocrine disruptor. Prenatal DES exposure has been associated with infertility and other reproductive disorders in adult women, but little is known about its effect on endogenous hormones. Data were derived from the Harvard Study of Moods and Cycles, a prospective cohort study of women aged 36-45 years from Boston, MA (1995-1999). Prenatal DES exposure was reported at baseline via self-administered questionnaire. Early follicular-phase concentrations of follicle-stimulating hormone (FSH), luteinizing hormone (LH), and estradiol (E2) were measured at baseline and every 6 months during 36 months of follow-up. Inhibin B concentrations were measured through 18 months. The analysis included 42 DES-exposed and 709 unexposed premenopausal women with intact ovaries. In each individual, hormone values were averaged over all time periods for which they were available; minimum and maximum values were identified. We used multivariable log-binomial and linear regression to estimate risk ratios (RR) and differences in mean log-transformed hormones ( $\beta$ ), respectively, comparing DES-exposed with unexposed women. DES-exposed women had higher levels of FSH (IU/I) (average:  $\beta=0.13$ , 95% confidence interval (CI): 0.00, 0.26; maximum:  $\beta=0.20$ , CI: 0.05, 0.36) and lower levels of estradiol (pg/ml) (average:  $\beta= -0.18$ , CI: -0.31, -0.05; maximum:  $\beta= -0.22$ , CI: -0.39, -0.05) than unexposed women. Only maximum levels of LH (IU/I) were higher in the exposed ( $\beta=0.23$ , CI: 0.05, 0.41). DES-exposed women had non-significantly lower levels of inhibin B (pg/ml) (average:  $\beta= -0.15$ , CI: -0.35, 0.05). RRs for the association of DES exposure with average FSH > 10 IU/I and average inhibin B < 60 pg/ml, indicators of low ovarian reserve, were 1.84 (CI: 1.22, 2.76) and 2.09 (CI: 1.04, 4.22), respectively. These data suggest that prenatal DES exposure may influence reproductive hormones in late reproductive-aged women.

**B124**

**A prospective study of laparoscopically-confirmed endometriosis and risk of hypertension and hypercholesterolemia**

**Mu F\*, Rimm EB, Rich-Edwards J, Spiegelman D, Missmer SA  
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**BACKGROUND:** Women with laparoscopically-confirmed endometriosis may have increased risk of heart disease, possibly through systemic inflammation and atherogenic lipid profile. The relation with hypertension and hypercholesterolemia is unclear. **METHODS:** We assessed the association between laparoscopically-confirmed endometriosis and self-reported hypertension and hypercholesterolemia, in a cohort of 116,676 registered female nurses enrolled at ages 25-43 and followed for >20 years. We fit multivariable Cox proportional hazards models to calculate hazard ratios (HR) and 95% confidence intervals (CI). **RESULTS:** 30,664 incident cases of hypertension and 47,584 of hypercholesterolemia were reported. Compared with women without endometriosis, women with laparoscopically-confirmed endometriosis had a significantly higher risk of hypertension (HR=1.14; CI=1.10-1.19) and hypercholesterolemia (HR=1.31; CI=1.27-1.35), adjusting for age (months) and calendar year. When further adjusting for demographic, reproductive, anthropometric, dietary, lifestyle and family history covariates, the associations remained unchanged. When additionally adjusting for endometriosis treatment factors (hysterectomy/oophorectomy, postmenopausal hormone use, or analgesic use), all associations were slightly attenuated but remained elevated and significant. When prevalent endometriosis cases were excluded or updated covariates were adjusted instead of baseline covariates, the associations remained unchanged. We found heterogeneity by current age for endometriosis and both hypertension and hypercholesterolemia risk (all p-heterogeneity < 0.005). Risk was highest among women age < 35 (hypertension HR=1.40; hypercholesterolemia HR=1.44) and lowest among women age > 50 (hypertension HR=1.07; hypercholesterolemia HR=1.12). **CONCLUSION:** In this large, prospective cohort, women with laparoscopically-confirmed endometriosis had higher risks of hypertension and hypercholesterolemia, which were not explained by known risk factors of hypertension or hypercholesterolemia nor by common endometriosis treatments.

**B125**

**Douching is associated with novel, bacterial vaginosis-associated bacterial infections**

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Background: Douching may alter the vaginal flora and predispose to bacterial vaginosis (BV). Further, douching may increase the risk of upper genital tract infection and inflammation, termed pelvic inflammatory disease (PID), by promoting the ascension of microbial pathogens from the lower to the upper genital tract. As several novel BV-associated bacteria have recently been identified, we sought to determine the relationship between douching and these pathogens among women with clinically suspected PID. Methods: Vaginal and endometrial samples collected from 672 women who participated in the PID Evaluation and Clinical Health (PEACH) study were tested for *Leptotrichia sanguinegens*(LS), *Leptotrichia amnionii*(LA), *Atopobium vaginae*(AV) and BV associated bacteria 1(BVAB1) using polymerase chain reaction. The relationships between douching  $\geq 2$  times in the past month and each of the bacteria were modeled using logistic regression, adjusting for age, race, marriage, education, alcohol consumption, smoking, and risky sexual behavior ( $\geq 2$  current sexual partners, new sexual partner past 4 weeks, or inconsistent condom use). Results: Women who douched were more likely to test positive for LA (ORadj 1.75 95% CI 1.02-2.99) and LS (ORadj 1.91 95% CI 1.17-3.11) than women who did not. Douching was not associated with AV and BVAB1. Conclusions: Among women with PID, those who douched were twice as likely to have cervical and/or endometrial leptotrichial infection. As the identification of modifiable factors associated with BV and PID is important for the reduction of reproductive sequelae including infertility, prospective and intervention studies examining the causal relationship between douching and BV-associated bacteria are warranted.

**B126**

**The role of pre-pregnancy body mass index and gestational weight gain in prenatal and postpartum depression**

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In non-pregnant populations, overweight and obesity predict development of depression, but this has been less studied in the perinatal period. Our objective was to examine the associations of pre-pregnancy body mass index (BMI) and gestational weight gain (GWG) with prenatal and postpartum depression. Study subjects were 1114 women in Project Viva, a prospective cohort study. We calculated BMI from self-reported weight and height and categorized women as underweight, normal, overweight, obese. GWG was the difference between weight at delivery and pre-pregnancy weight, classified by 2009 Institute of Medicine recommendations. We assessed depression at mid-pregnancy and 6 months postpartum with the Edinburgh depression scale; score >12 indicated depression. The majority (63%) had normal BMI, 21.9% were overweight, and 11.9% were obese. Ninety (8.1%) women experienced prenatal depression and 57 (5.1%) experienced postpartum depression without prenatal depression. In logistic regression models adjusted for sociodemographic and health factors, overweight (v. normal weight) before pregnancy was associated with elevated odds of prenatal depression (OR=1.9; 95% confidence interval (CI):1.2-3.3) but not postpartum (OR=0.8; 95% CI: 0.4, 1.8). Obese BMI was associated with postpartum depression (OR= 2.3; 95% CI: 1.1-4.6) but not prenatal OR=1.1; 95% CI 0.5, 2.3). We did not detect an association of GWG with prenatal or postpartum depression or an interaction between BMI and GWG. Being overweight or obese before pregnancy may increase risk of perinatal depression, suggesting the importance of pre-pregnancy and inter-partum efforts to achieve a healthy weight.

**B127**

**Endometriosis diagnosis and staging: Are surgeons' assessments consistent?**

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Endometriosis, a common cause of female infertility and pelvic pain, is prone to misclassification due to its diagnostic reliance on surgical visualization. Our objective was to determine agreement of endometriosis diagnosis and staging between operating surgeons and subsequent expert review. 148 women were randomly sampled, stratified on endometriosis diagnosis, from the Endometriosis: Natural History, Diagnosis and Outcomes Study for the Physician Reliability Study. Immediately after surgery, operating surgeons were asked to give a diagnosis and both an intuitive and checklist-assisted disease severity rating according to the revised American Society for Reproductive Medicine (rASRM) criteria. After viewing digital images, 4 expert reviewers likewise indicated diagnosis and severity (intuitive and checklist assisted). Reviewers repeated their assessments after sequentially viewing the operative report, MRI, and histopathology findings. Surgeons and reviewers had substantial agreement on intuitive diagnosis and checklist-assisted staging after viewing digital images (mean  $\kappa=0.61$ , range: 0.55-0.63 for diagnosis; mean  $\kappa=0.64$ , range: 0.53-0.78 for staging) and after additionally viewing operative reports (mean  $\kappa=0.83$ , range: 0.82-0.87 for diagnosis; mean  $\kappa=0.85$ , range: 0.84-0.86 for staging). The MRI or histopathology findings resulted in no diagnostic or staging improvement. Percent agreement for intuitive versus checklist-assisted staging was 17-35% lower for all scenarios. Endometriosis diagnosis and staging among experienced surgeons is consistent, particularly when using the rASRM checklist. Reviewing operative reports in addition to digital images greatly improves diagnostic agreement, while MRI or histopathology findings may be less useful adjuncts. How endometriosis staging correlates with clinical outcomes remains to be developed.

## **Movin' on up: The effect of social mobility on fetal growth in a cohort of pregnant women residing in Michigan**

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Fetal growth is associated with health along the lifecourse. Only a handful of studies have examined the influence of maternal socioeconomic status (SES) mobility (childhood to adulthood) on fetal growth. This study used data from 2,463 women (1824 White and 639 African American) enrolled in the Pregnancy Outcomes and Community Health (POUCH) Study. In multinomial logistic regression analyses the outcome, fetal growth, was modeled as three levels; the referent appropriate-birthweight-for gestational-age (AGA), small-for-gestational-age (SGA), and large-for-gestational-age (LGA). The exposure measures were: maternal childhood SES based on her parents' education-level, occupation, and receipt of public assistance; and adult SES based on maternal education-level, household income, occupation, Medicaid status, and paternal education-level and occupation. Women were grouped into three SES levels (low, middle, upper) at childhood and adulthood. Women were then classified according to SES mobility; women who's SES changed were compared to two reference groups, the SES group they left and the group they joined. Upward SES mobility was associated with decreased risk of delivering an SGA infant. The adjusted-odds ratio (aOR) of SGA was 0.37 (95% Confidence Interval [CI]: 0.19-0.74) for women who moved from lower to middle/upper vs. static\_lower SES, and 0.54 (CI: 0.28-1.04) for women who moved from middle to upper vs. static\_middle. There were no significant differences in SGA risk when women were compared to the SES group they joined. Women who moved from middle to upper SES were more likely to deliver an LGA infant. Our findings support a link between SES mobility and fetal growth.

## **Perceived neighborhood social and physical environment and preterm delivery in African American women**

**Sealy-Jefferson S\*, Misra DP, Caldwell C, Straughen J, Slaughter J, Dailey R, Helmkamp (Wayne State University School of Medicine, Detroit, MI)**

Perceived neighborhood environment may influence preterm delivery (PTD) rates through several mechanisms. Few studies have examined this relationship among African Americans (AA). Using data collected from 2009-2012 in the Life-course Influences on Fetal Environment study of preterm birth among post-partum AA women in the Detroit-metropolitan area (n=1411), we tested whether neighborhood social and physical environment was associated with increased PTD rate (defined as birth before 37 completed weeks of gestation). Validated neighborhood scales were used to measure women's perceptions of their neighborhood (higher=better): healthy food availability, walkability, safety, social cohesion, number of neighborhood-based social ties, and social disorder (higher=more disorder). Participants also ranked their neighborhood quality (1=excellent/2=good/ 3=fair/4=poor) and reported experiences of neighborhood violence against themselves or their family members (yes/no). Preterm delivery occurred in 16.4% (n=231) of the cohort. In bivariate log-binomial models (scales modeled continuously), we found no association between perceived neighborhood environment and PTD. However, education significantly modified several of the bivariate associations (interaction p-values <0.05). Women with 'no' college education exhibited decreased PTD rates as the following neighborhood scales increased: healthy food availability (prevalence ratio (PR): 0.90; 95% Confidence Interval (CI):0.82, 0.99), walkability (PR: 0.94; CI: 0.89, 0.99), and safety (PR: 0.96, CI: 0.92, 0.99). Women with no college also exhibited increased PTD rates as neighborhood social disorder increased (PR: 1.05, CI: 1.01, 1.09). No associations between neighborhood environment and PTD were found for women with some college or more. These results suggest that for women with fewer resources, neighborhood environment may significantly affect PTD rates.

## **Neighborhood poverty and preterm birth revisited: Comparing cross-sectional measures to longitudinal poverty trajectories**

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Background. Neighborhood poverty is associated with increased risk of preterm birth (PTB); however, most of this research uses cross-sectional measures of neighborhood poverty. We hypothesize that the longitudinal poverty experience of a neighborhood may influence factors important to perinatal health such as psychosocial stress or access to health-promoting resources. Our objective was to compare the associations between neighborhood poverty and PTB using both cross-sectional and longitudinal measures of poverty. Methods. We categorized California neighborhoods (i.e., census tracts) as having low (<5% poor), moderate (5-20% poor), or high (>20% poor) cross-sectional poverty based on data from the American Community Survey 2005-2009 (ACS). We then estimated longitudinal poverty trajectories from 1970-2009 using data from the ACS and the Neighborhood Change Database using three methods: a priori categorization, latent class growth modeling, and non-parametric clustering. We used logistic regression to estimate associations between neighborhood poverty measures and PTB for 24,394 women in the Maternal and Infant Health Assessment who gave birth between 2003-2009. Results. High (compared to low) neighborhood poverty based on cross-sectional data was not associated with PTB after adjustment for individual-level demographic and socioeconomic factors (OR=1.03, 95% CI=0.88,1.21) . However, trajectories characterized by long-term high (compared to long-term low) neighborhood poverty were associated with 30-40 percent increases in odds of PTB in fully adjusted models (e.g., OR=1.39, 95% CI=1.17, 1.64), regardless of method used to estimate trajectories. Conclusions. The longitudinal poverty experience of neighborhoods may be more strongly associated with factors influencing birth outcomes compared to cross-sectional measures of poverty.

## **Preconception allostatic load and racial disparities in preterm birth, low birth weight, and small-for-gestational age: The Bogalusa Heart Study**

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Large disparities in adverse birth outcomes persist between African American and White women in the US despite decades of research and advancements in prenatal care. The theoretical construct of allostatic load (AL) represents an integration of the life-course perspective and the harmful physical health effects of chronic stress leading to earlier health deterioration among racially or socioeconomically disadvantaged groups. The purpose of this investigation was to examine the relationship between maternal AL prior to conception and the occurrence of preterm birth, small-for-gestational age, and low birth weight infants among a cohort of White and African American women participants in the Bogalusa Heart Study. Data from 431 women were linked to the birth record of their first born infant using Linkpro v3.0. Eight biomarkers were available for analysis, and AL index was computed by summing the number of biomarkers falling within the highest risk quartile of the age-adjusted sample distribution. Log-linear modeling was used to examine relationships between race, AL, and education, and the three birth outcomes of interest, controlling for smoking during pregnancy, length of time prior to conception, and maternal age. The relative risks for all three adverse birth outcomes appeared to increase with increasing AL as hypothesized; however, none of the relationships between AL and birth outcomes were statistically significant in adjusted models. Further, there was no evidence of effect modification by race or maternal education level. More work is needed in understanding the biological mechanisms linking social inequities to racial disparities in adverse birth outcomes.

## **The relationship between race/ethnicity and major birth defects in the United States, 1999-2007**

**Canfield MA\*, Mai CT, Wang Y, Marengo LK, O'Halloran A, Olney R, Kirby RS  
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We conducted a population-based epidemiologic study of the relationship between race/ethnicity and 27 major birth defects, using pooled data from 12 US states in the National Birth Defects Prevention Network (NBDPN) that include 13.5 million live births (>1/3 of total US births) over a 9-year period (1999-2007). For both cases and all live births, maternal race/ethnicity was derived from the birth record. Using Poisson regression, prevalence estimates (cases per 10,000 live births, with 95% confidence intervals (CIs)) were calculated for each birth defect and each of 12 racial/ethnic groupings, along with crude and adjusted prevalence ratios (aPRs, with 95% CIs, controlling for maternal age and state of residence), with non-Hispanic whites serving as the referent group. American Indians/Alaska Natives had a significantly higher and 50% or greater prevalence for 7 conditions (e.g. aPR=4.0 (95% CI=2.9-5.4) for anotia microtia; aPRs=1.9-2.1 for cleft lip, lower limb reduction deformities, and encephalocele). Asians (especially Chinese and Asian Indians) had either significantly lower or similar prevalences compared to whites, with the exception of anotia/microtia among Chinese (aPR=2.1) and Vietnamese (aPR=1.9) and tetralogy of Fallot among Filipino (aPR=1.6). Among Cubans, we observed 8 significantly lower prevalences (e.g. aPR=0.4 for trisomy 18). This study represents the first time that there has been sufficient sample size to systematically examine the prevalence of such a range of birth defects across so many racial/ethnic groups, including American Indians, Asian subgroups, and Hispanic subgroups. The relatively high prevalence of selected birth defects in American Indians/Alaska Natives warrants further attention.

## **Gestational weight gain and early childhood growth and obesity**

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We examined the association between gestational weight gain (GWG) and infant growth as well as childhood obesity in the Maternal Health Practices and Child Development pregnancy cohort (n=743). Excessive and adequate GWG were defined using 2009 Institute of Medicine guidelines. Child's weight and length were measured at birth, 8, 18, and 36 months, and triceps skinfolds at 18 and 36 months. We used the 2006 WHO growth standards to calculate weight-for-age Z-scores (WAZ) for children <24 months and the 2000 CDC growth references for children  $\geq 24$  months, per current recommendations. A body mass index (BMI) Z-score  $\geq 95$ th percentile of the 2000 CDC references defined child obesity at 36 months. 45% of women gained excessive weight and 13% of all children were obese at 36 months. For all GWG groups, WAZ increased from birth to 18 months and decreased from 18 to 36 months. In multilinear mixed models adjusting for prepregnancy BMI, income, child's age, and prenatal substance use, excessive GWG was associated with higher WAZ at birth compared with adequate GWG [coefficient (95% CI): 0.28 (0.10, 0.47)]. There was no association between GWG and WAZ at 8 or 18 months. By 36 months, excessive GWG was associated with a higher WAZ compared with adequate [0.29 (0.11, 0.48)]. Excessive GWG was associated with childhood obesity [aRR (95% CI): 2.47 (1.41, 4.34)] and elevated triceps skinfolds [1.63 (1.08, 2.44)] at 36 months. GWG is a potentially modifiable factor that may influence infant growth pattern and obesity development in early childhood.

## **Maternal smoking during pregnancy and offspring mortality up to early adulthood: A prospective population based Swedish cohort study**

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**Objectives:** To investigate the association between maternal smoking during pregnancy and mortality from ages 1 to 23 years and whether a possible association was confounded by familial factors. **Patients and Methods:** In a population-based Swedish cohort comprising 1 905 179 children, born between 1983 and 2005 and surviving at least 1 year of age, we examined the association between maternal smoking during pregnancy and offspring mortality up to 23 years of age. Unadjusted and adjusted hazard ratios (HR) with 95% confidence intervals (CI) were estimated using Cox regression. We also investigated the association within siblings, controlling for common genes and shared environment using stratified Cox regression. **Results:** The risk of dying was increased with increasing maternal smoking habits: adjusted hazard rate ratio 1.15, (95% confidence interval 1.04 to 1.27), and 1.28 (1.14 to 1.44), for 1-9 cigarettes per day, and more than 10 cigarettes per day, respectively, compared to non-smokers. The effect of maternal smoking during pregnancy on offspring mortality was not present when the association was evaluated within full (adjusted within sibling component in full siblings: hazard rate ratio 1.13, (0.79 to 1.60) and half sibling pairs: hazard rate ratio 0.91(0.36 to 2.30). **Conclusions:** Maternal smoking during pregnancy was associated with increased offspring mortality in ages 1 to 23 years, but the association appears to be confounded by familial factors.

## **Association of maternal prenatal trans fatty acid consumption with infant and child cognition in a U.S. cohort**

**Cohen JFW\*, Rifas-Shiman SL, Rimm E, Gillman MW, Oken M  
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Trans fatty acid consumption during pregnancy may block the transfer of omega-3 fatty acids to the developing fetus or interfere with omega-3 metabolism, which could reduce cognition during infancy or childhood. Using data from 1526 participants enrolled in 1999-2002 in Project Viva, a pre-birth cohort study, we studied the association of maternal trans fatty acid consumption, assessed using a validated semi-quantitative food-frequency questionnaire in each of the 1st and 2nd trimesters of pregnancy, with infant and child cognition. We measured cognition by the % novelty preference on visual recognition memory testing at 6 months, the Peabody Picture Vocabulary Test at 3 years, the Wide Range Assessment of Visual Motor Abilities at 3 and 7 years, and the Kaufman Brief Intelligence Test and Wide Range Assessment of Memory and Learning (WRAML) at 7 years. After adjusting for participant characteristics, maternal IQ, and home environment using multivariable linear regression, we found that trans fatty acid intake during the 2nd trimester was inversely associated with WRAML score at age 7 (-1.7 points; 95% CI -3.2, -0.2 for each 1% increment in energy from trans as a replacement for saturated fats). Trans fatty acid consumption during the 1st or 2nd trimester was not associated with the other cognitive test scores at ages 6 months, 3 years or 7 years. These findings raise the possibility that maternal intake of trans fatty acids during mid-pregnancy may modestly decrease offspring memory and learning.

## **Caffeine intake during pregnancy and risk of cerebral palsy in offspring: A joint study in three large Nordic birth cohorts**

**Tollanes MC<sup>1</sup> \*, Strandberg-Larsen K<sup>2</sup>, Bech BH,<sup>3</sup> Moster D<sup>4</sup>, Henriksen TB<sup>5</sup>, Eichelberger K,<sup>6</sup> Wilcox AJ<sup>7</sup>**

**(<sup>1</sup> University of Bergen, Norway; <sup>2</sup> Health and Medical Sciences, University of Copenhagen, Denmark; <sup>3</sup> Institute of Public Health, Aarhus University, Denmark; <sup>4</sup> Department of Global Public Health and Primary Care, University of Bergen, Norway and Norwegian Institute of Public Health, Norway; <sup>5</sup> Department of Clinical Medicine - The Department of Paediatrics, Aarhus University, Denmark; <sup>6</sup> Department of Obstetrics and Gynecology, University of North Carolina School of Medicine, USA; <sup>7</sup> Reproductive Epidemiology Group, National Institute of Environmental Health Sciences, USA)**

Cerebral palsy (CP) affects two in 1000 liveborn. Postnatal caffeine exposure is associated with a reduced risk of CP in low birth weight neonates. We sought to explore if antenatal caffeine exposure was associated with the risk of CP. Data on caffeine intake during pregnancy were obtained from three birth cohorts - the Danish National Birth Cohort, the Aarhus Birth Cohort and the Norwegian Mother and Child Cohort Study, comprising a total of 167,572 pregnancies and 311 CP cases. CP diagnoses were validated through record linkage with the Danish CP registry and self-report in Norway. Associations were investigated in Cox regression models, with adjustments for maternal age, socio-occupational status, assisted reproductive treatment and smoking. In Denmark, increasing the daily number of cups of coffee in early-mid-pregnancy increased the risk of CP (p-value for trend=0.04). For children exposed in utero to 6+ cups a day the relative risk (RR) of CP was 1.6 (95% confidence interval (CI) 1.0-2.7) compared with non-exposed. In Norway, daily intake of 6+ cups of coffee in late pregnancy compared to no intake was associated with excess risk of CP in offspring (RR 3.4, 95% CI 1.3-9.0), whereas intake before or earlier in pregnancy was not. Exposure to 2+ servings of cola daily in mid-pregnancy resulted in a RR of CP of 3.4 (1.6-7.3). These findings suggest that antenatal exposure to caffeine, or related factors, may increase the risk of CP. We will explore types of caffeinated beverages and timing of exposure in more detail.

## **Maternal smoking, breastfeeding, and growth and risk of overweight during infancy**

**Shenassa ED\*, Wen X**  
**(University of Maryland, College Park)**

Breastfeeding provides infants with nutrients and hormones that appear to protect against risk of overweight but can also provide clinically significant amounts of tobacco compounds. Thus, a question arises regarding the joint effect of maternal smoking and breastfeeding on growth and risk of overweight during infancy. **Methods:** We used historical data (N=23,571) from the US Collaborative Perinatal Project to conduct the first study of the net effect of exposure to tobacco compounds via breast milk on growth and risk of overweight during infancy. We stratified infants by maternal smoking and feeding type, and then fit interaction terms to isolate the net effect of exposure to tobacco compounds via breast milk from exposure in uterus and in ambient air after birth. **Results:** The risk of overweight at 1 year of age associated with maternal smoking among breastfed infants was similar with that among bottle-fed infants. The association between maternal smoking and infancy weight gain was marginally greater among breastfed infants (adjusted mean difference, 0.23 kg [95% CI, 0.08 to 0.38]) than among bottle-fed infants (0.14, [95% CI, 0.09 to 0.19]). **Conclusions:** Among this sample maternal smoking and breastfeeding each appear to be associated primarily with the risk of overweight through influencing the upper tail of the BMI distribution rather than shifting the entire BMI distribution. Implications of these findings are discussed in terms of catch-up growth, confounding by SES, and potential biologic pathways.



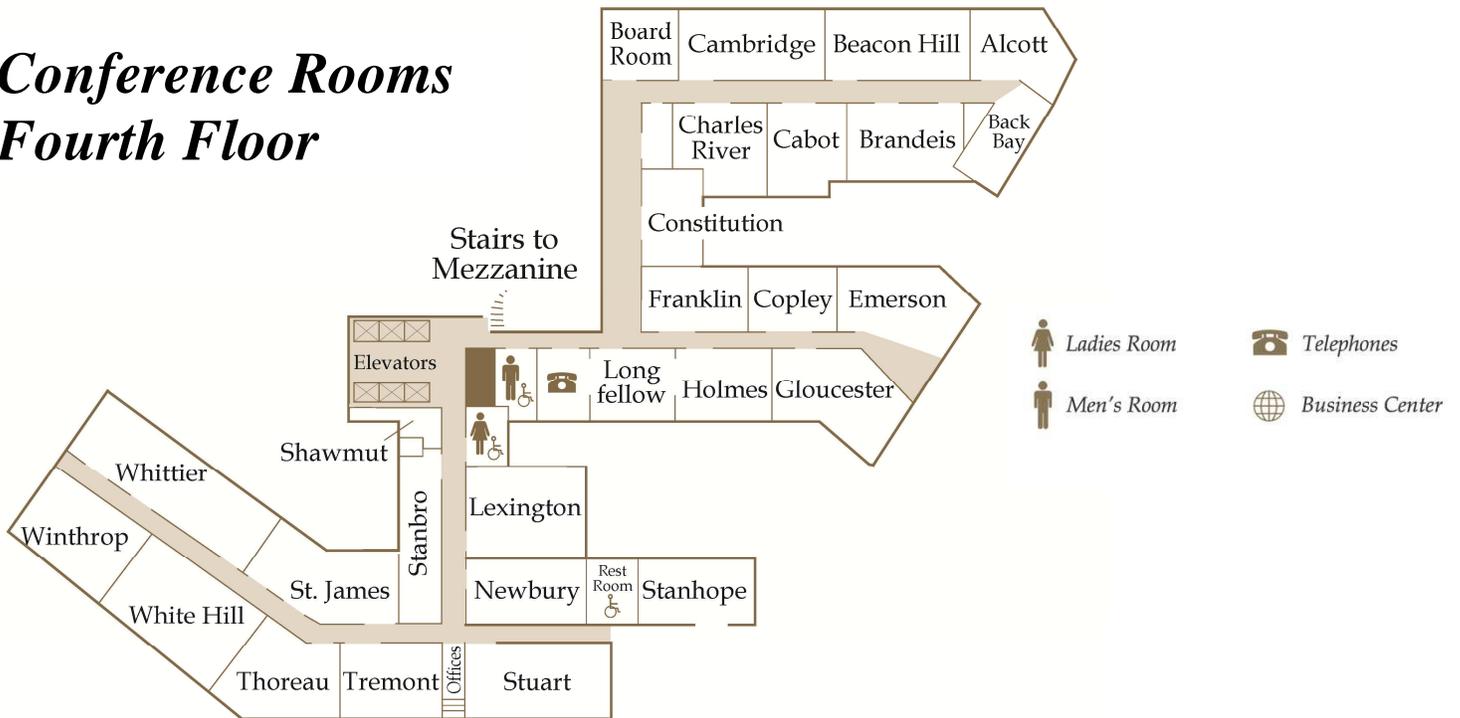
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